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THE WILDERNESS AND ITS TENANTS

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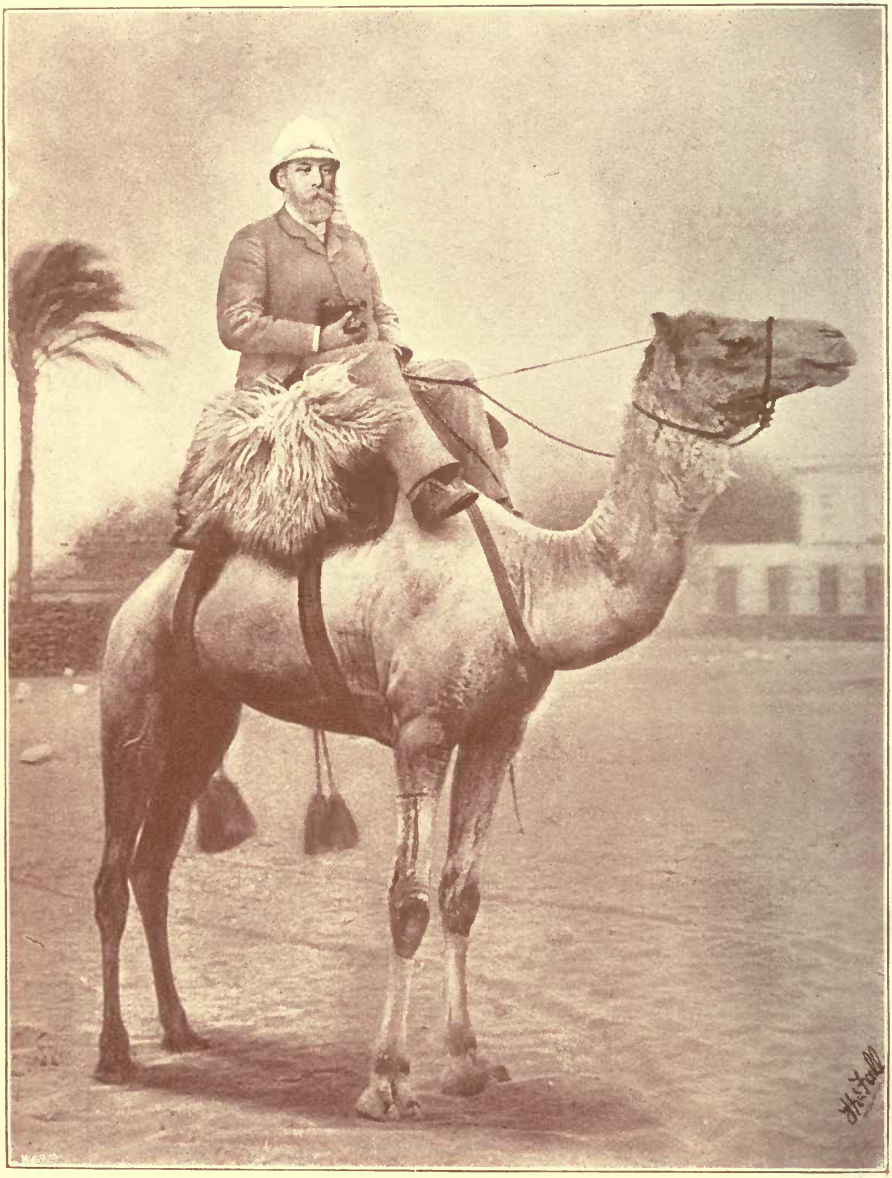
THE WILDERNESS AND ITS TENANTS



THE
WILDERNESS AND ITS TENANTS

A SERIES OF

GEOGRAPHICAL AND OTHER ESSAYS

ILLUSTRATIVE OF LIFE IN A WILD COUNTRY

TOGETHER WITH

EXPERIENCES AND OBSERVATIONS

CULLED FROM THE GREAT BOOK OF NATURE

IN MANY LANDS

BY

JOHN MADDEN

IN THREE VOLUMES

VOL. I

LONDON

SIMPKIN, MARSHALL, HAMILTON, KENT & CO., LTD.

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1897

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PREFACE

"Oh, that mine adversary had written a book." *Job* XXXI—25.

It is usual for authors to preface their books with a short statement of the leading features of the work they are about to place before the public. In the present case, for several reasons, which will probably be apparent to the reader as he turns over these pages, it appears to be particularly desirable to begin this book with such an explanation; as its design will be found to differ a good deal from that of other books, upon kindred subjects, which have already been published.

The Author is unable to conceal from himself that the scope of this work is somewhat ambitious—that is to say, it deals with a vast variety of different topics, introducing details, many of which have certainly (so far as his researches have extended) never been collected into any single work before. A number of points will also be found debated in these pages, which he ventures to believe have not been previously touched upon in any other work; other subjects again, have been presented in a new, and as he humbly hopes, in a not uninteresting or uninstructive form.

At any rate, the Author's constant object and desire has been thus to present them; it will be for the reader to judge how far he has succeeded in this design.

But inasmuch as nothing is ever done in Nature without some definite object, and in pursuance of a regular system of law; the Author has constantly endeavoured, throughout these volumes to interpret, as far as he has been able, what have seemed to him to be *the causes* of the various phenomena which have been described. In doing so, however, as the reader will see, the student of Nature is brought face to face in almost every instance, with a series of details, involving the consideration of one or more questions of scientific enquiry. The individual man might therefore well stand appalled at the wide extent of research, which even a very partial attempt to deal successfully with all these topics, is sure to cast upon him. The Author has been painfully impressed with this fact, but that has not seemed to him to be a reason which ought to cause him to hesitate to do his best in this direction.

Of course it would be impossible to suppose that a work involving so great a variety of technical matters as are here attempted to be dealt with, would not be defaced by many errors and shortcomings; all that the Author has a right to expect, however, is, that under the circumstances, his readers will make due allowance for the difficulties of the task which he has attempted to perform; and he is sure that he will not appeal in vain to the British Public, for their kindly consideration in this case.

As for himself, though the compilation of these pages has involved unremitting literary labour, of many years' duration: the Author can only say, the work to him has been a labour of love; and he parts from it upon its completion, as from an old and valued friend—his constant companion for years. The numerous references to the works of other authors, some of which will be found on almost every page, will give some idea of the variety and extent of the research which has been necessary to obtain what seemed to be the best and most valuable information, on the different points discussed. The Author has in all cases, wherever possible, always endeavoured to fortify his own opinion by quoting that of other writers, who may have made special studies of the different branches of literature or of science, which may have been touched upon; in order that where he has erred, he may, so to speak, do so in good company, and after consulting the best authorities extant. The fallibility of the human understanding has constantly been recognised by all who have given close attention to the examination of natural phenomena, but it is only when the student comes to seek for facts relative to some of the matters treated of in these volumes, that he becomes aware of the paucity of observations which have been recorded about them in books, and how little is really known about such things.

It will be observed that the Author has generally avoided speaking of himself. Egotism, in treating of such subjects, has seemed to him both unnecessary and unbecoming, as well as

likely seriously to mar the narrative, when describing the splendour of the great phenomena of Nature. The individual in all such cases, ought to be as nothing: Nature and Science, to count as everything. For these reasons he has forborne to speak continually of himself; he feels that the personal pronoun—"I"—"I"—"I"—would grate harshly upon the nerves, as a blot upon a work which he has done his best to make as free from obvious defects, as he could.

As regards the general plan of this work—this has caused its author a good deal of consideration; inasmuch as it embraces a great variety of details, difficult to arrange after a continuous fashion. It might have seemed perhaps, that it would have been better to divide it into a series of separate works. After much thought, however, the Author has come to the conclusion, that it is on the whole wiser to let it go together, as one book.

The narrative is supposed to represent the progress of a traveller, by land and sea, through each of the terrestrial zones; for the study of physical geography teaches us that the earth's surface has been arranged by Nature, in a series of belts, or zones, as we shall call them, which extend more or less around its whole circumference: each of these regions being distinguished from the others, by its own special range of climate and vegetation.

The division of the earth into climatic zones is, however, by no means a new one; similar attempts having been already made by several geographers. The reader as he goes along, will see what our efforts have been in this direction. It will be enough,

with regard to this, to say at present, that the first and second volumes are mainly devoted to a description of these zones. It may be objected that they embrace the world's whole terrestrial surface, and not merely those portions of it which are (or lately were) in a state of Nature.

That is so—but we have specially chosen the wild and uncultivated domain of Nature—tracts of which still exist in all countries—for our study, for several reasons, which will appear more clearly further on in this work—but principally because there we see the world, as Nature herself first laid it out, unchanged by the results of human occupation, with its consequent almost complete transformation of the landscape, including its original fauna and flora.

Who for instance would recognize, the weedy clearing of the American back-woods, with its rude log-huts, their shabby occupants, and fire-blackened stumps dotted over the fields, as the grand primeval forest country of Oregon or California? Who would regard the South African grass veld, over whose dreary monotonous surface one may now travel for hundreds of miles, without seeing a single head of game of any description; as the country, where just half a century ago, Gordon Cumming chased the magnificent herds of wild game, which then literally covered the country? If we see a tree there, the great chances are it belongs, not to the South African, but to the Australian forest flora! If we see a beast, it is probably an ox, a horse, or a sheep, introduced into the country by the European settler!

If therefore we desire to describe Nature in its original beauty and splendour, it has always seemed to us, that it is best seen in the wild, or wilderness country. In regions where the ultra-civilization of modern life prevails, we do not see it thus: what we see is an artificial landscape arranged after the tastes and fancies of its human inhabitant. Taking our own country for instance, as an example of the changes that have occurred, we find its ancient records show that Great Britain in its natural state, was mainly a land of forests, swamps, and moorland. How different is its present condition!

The reader will please to remember, that the question as to which is better than the other, does not arise: our design is to describe Nature "unadorned," and as she is, or rather was. At the same time we are fully conscious of the improvement of many natural products through cultivation. Who, for instance, would recognize the splendid Hybrid perpetual rose of our gardens, as the wild rose of our hedgerows? Who would see in the short-horned cattle, or the Berkshire pig, the same animals as their wild ancestors?

All that we say is, that these are not the same as the original productions of Nature. These things exhibit the power of human agency to modify the works of Nature. But Nature for her own wise reasons will have none of them; and were human culture to be withdrawn, in a comparatively short time both the flower and the cattle would have followed their owners, to that land where all things are forgotten.

Savage life is however repugnant to many persons,

on account of its apparently inhospitable and unsocial character. That being so, we have commenced our work by making, for the contemplation of our readers, a collection of the written opinions, given as the result of a life's experience, by some of the world's greatest travellers and hunters; and have left them to describe in their own words, how deeply the wild charms of Nature had bewitched them. These quotations are given without comment by us, and will follow the introductory chapter to our first volume.

Such a collection of opinions on this subject has never before been brought together. We may say the same with reference to our collection of accounts of the great herds of game, seen in former days, contained in Volume III. To these latter we have appended some lines by Thomas Pringle, the poet of South Africa, descriptive of that hunters' paradise, as he saw it in the early part of this century. This poem, though now very generally forgotten by the world, created at the time that it was written great sensation and attention in literary circles; as will be seen by some details with reference to it which have been reproduced. We may add that the Colonial authorities in South Africa, are unanimous in regarding it as the best, and most life-like picture of the great hunting days, which is extant. It is for that reason that we have ventured to embody it in these pages.

Our geographical essays, which contain a series of sketches of the terrestrial zones, their scenery, and productions, and of the wild people who

inhabit them, would manifestly be incomplete without some account of the game, from a sporting point of view, both by flood and field, for which the wilderness has been so celebrated. These sporting sketches form the greater portion of our third volume.

Lastly, in a work somewhat technical in many of its details, we have been impressed with the importance of a complete index, by means of which any desired subject treated of in these pages, can be readily referred to. This index, comprising some two thousand items, is placed at the end of Volume III. It has of course necessitated considerable literary labour in its compilation. If however, it serves the purpose for which it was intended, we shall by no means deem the time expended upon it as lost.

HILTON PARK, December 1896.

The Wilderness and Its Tenants.

CHAPTER I.

INTRODUCTION.

The Domain of Nature. Value of Experiences gained in a Wild Country. The Senses blunted by City Life for Observation of Natural Details. Attractions of Wild Life and Scenery. The Hunting Instinct in Mankind. The Spirit of Adventure. Home and Foreign Field Sports. The White Conquest of America. The Aboriginal Races of Mankind. Changeless Aspect of the Wilderness. Inhabitants mostly Confined to Village or City Communities. Cemeteries in the Plain. Deep Travel-worn Paths. Civilized Man and Wild Game. The Red Man and the White. "The White Man's Fly." An Indian Chief's Appeal to the Mercy of his White Conquerors. Darwinian Theory of the Survival of the Fittest. Life as an Incessant Warfare. Mr. Froude on the Disappearance of Wild Races. Opinions of Great Hunters and Travellers upon Life in the Wilderness. Travelling in Search of Health. Unnecessary Hardships to be Avoided. Habits of Observation the First Qualification for a Traveller.

WHEN the old traveller proceeds to review the various topics connected with such a subject as that of "The Wilderness and Its Tenants" (or in other words "The Domain of Nature," as distinguished from the settlements and habitations of Man), he finds himself met at the outset by a crowd of recollections, which rise up like spectres before the mind's eye, and, after the manner of champions in the old Olympian games, seem to contend with each other for a leading place in the narrative.

There is perhaps hardly a single one of these which does not recall some circumstance worthy of note, connected either with some picturesque scene, or dramatic incident, which has fixed itself indelibly upon the memory. If the life of a traveller is not full of such recollections it must be due to some defect in his own powers of observation, for no drama that has ever been acted upon the boards of a play-house can compare in variety, or in sensational incident, with that which is being continually acted in the great Theatre of Nature. This is the view which has impressed itself more and more deeply upon our mind as we have laboriously arranged these pages.

It might be supposed that residence in a savage land would usually be exceedingly bad for a man; and be certain in almost all cases to have a decidedly unfavourable effect upon the mind and character of members of a civilized community. Whatever influence a permanent withdrawal from the softening influence of civilized life might have in this way, we hold that a temporary sojourn in the wilderness ought to have, and in many cases certainly has, a directly opposite effect. There a man is of necessity left in direct communication with Nature; the cares of a busy world have been left behind him, and, except the daily routine of travel, there is generally nothing to distract the mind in its contemplation of the phenomena of Nature. In Europe, as we know, the man harassed by the cares of business seeks repose at some quiet spot at the seaside, or in some secluded mountain valley—that is to say, he unconsciously seeks, for this purpose, the nearest approach to the wilderness within his reach;—but in America, where considerable tracts

of country still remain in a state of nature, it is a very common thing for men oppressed by over-work, or mental worry, to go into camp, in the woods or on the plains. * The balmy incense of the pine forest, or the brisk air of mountain solitudes, is often found the most powerful of all tonics for the disordered digestion or overtaxed brain. The gay watering-place may suit the fancy of the *blasé* woman of fashion, but is often of questionable benefit to the brain-worker.

There is another aspect of this question which is less generally understood, namely, that a residence in a wild country opens up to a man of observant habits, or scientific tastes, a new form of highly technical education of a most valuable kind.

Here, circumstances teach the unobservant to observe; and it may be very safely assumed that a well-balanced, highly educated mind can hardly pass through even a few weeks of such a course of training, without acquiring great and permanent benefit. Experience, for example, has conclusively shown the immense value, to every man, of a short course of military discipline and instruction. Now, the life of a traveller in the wilderness is very much like that of a soldier in the field: nor is it too much to say that every soldier will return to barracks a better soldier, after a few weeks' camping on his own resources in a wild country. Nature herself is there our commanding officer, necessity our drill sergeant; we must learn to be self-reliant, to use our eyes and ears, and to make a note of what we see. Rank, wealth, or book-learning,

* During 1896 appeals for help towards fitting out recreation camps for city boys, appeared in the leading London papers—the experiment having been tried in 1895 with conspicuous success.

can here do comparatively little for a man. The proud or boastful man is put to silence and acknowledges his own littleness. If a crisis arises, the direction of affairs must be left to the practised woodsman or hardy pioneer, even though that man cannot read a printed book.

The late Mr. Francis Parkman, the Historian of Canada, a most learned scholar and indefatigable literary worker (who tells us that he himself first learned his own powers on the prairies, among the Indians of the Far West), has left us many striking passages scattered here and there throughout his works, showing how strongly he was impressed by the value of experiences and the spirit of self-reliance gained in a savage land. We shall quote but a single instance of such passages to be found in these charming and instructive works, where he says—

"The nursling of civilization, placed in the midst of the forest, and abandoned to his own resources, is as helpless as an infant. To the practised woodsman the Forest is a home, and yields him food, shelter, and raiment, and he threads its trackless depths with undeviating foot; guiding his course by the wind, the streams, or the trees. Such are the arts which the white man has learned from the red, who reads the signs of the forest as the scholar reads the printed page. With us the name of savage is a byeword of reproach—the Indian looks with equal scorn on those who, buried in useless lore, are blind and deaf to the great world of Nature——" *

This strange blindness to the great features of Nature is indeed remarkable! and it would almost seem as if persons of high intellectual attainments are

* *The Conspiracy of Pontiac*, by Francis Parkman, 1885, Vol. i, pp. 159, 160.

often singularly helpless and stupid in this respect. When alone, and thrown upon their own resources, they simply lose their heads. Mr. Parker Gilmore relates a notable instance of this in the person of one of his companions, a highly educated gentleman, and one who had moreover distinguished himself at his University: such cases are by no means uncommon.

"Of all the hunting companions I have ever had (he says), —and they have been numerous enough—I never was associated with one who had a poorer idea of direction. It has puzzled me, times beyond count, how any man could be so stupid in this respect, and it sometimes quite used to make me lose my temper to see with what persistency he would adopt a wrong course, and worse still, stick to it, in spite of all argument and persuasion." Mr. Parker Gilmore then goes on to observe that he "has invariably found that the higher the type of man, in breeding and educational acquirements, the more certain he is to be an adept at wandering, when left to his own resources"—Whereas "The lowest organizations to be found in the human family, such as the Digger Indian, and the Bushman, never get lost. However similar the landscape, they will retrace their steps to their starting point without hesitation or doubt." *

Now to what are we to attribute this strange incapacity? Is it some inherited defect, bred in the organization of the higher type of humanity—or is it simply due to want of training in the practical habits of every-day observation?

We are decidedly disposed to adopt the latter view. Intelligence, we believe, is sure to tell in the long run, provided it is properly trained and directed. The

* *The Hunters' Arcadia*, by Parker Gilmore, 1886, pp. 100, 101.

educated scholar, living in the midst of an ultra-civilization, fails, because he has never had to study the details of a landscape where human landmarks have never been set—and drifts he knows not whither, like a sailor at sea, in thick weather, without a compass. The sense of direction, and the faculty of knowing where one is, is quite as much a matter of education as the acquirement of any other branch of knowledge.

Experience, however, shows that it is quite possible for the white man to learn all the arts of the Indian. With practice and application he may gradually acquire the art of knowing how to hold his course through an unknown land, and to follow the trails or marks left by game or hostile natives, with all the unerring certainty of the Red man. In such cases his superior intelligence (should he adopt the hunter's life) will undoubtedly in the end enable him to beat the Indian at his own game, though it may be quite true that, as a rule, few white men have ever attained to that degree of proficiency. Still we have known such men.

Those whose researches may have carried them much into the early literature of America, and the history of the settlement of the New World by the European invaders, will be conversant with the all-powerful influence which the attractions of the wilderness developed among those who emigrated to seek a home in those Western Wilds.

The numbers of those who, tired of the dull routine of existence in the settlements, have adopted the wandering life of the hunter, have always been great. Many of these men became to all intents and purposes

Indians, and were skilled in all the arts of the Red man. Nearly every Indian tribe numbered a certain proportion of Whites among its adherents. Still more remarkable were the cases of those who were forcibly carried off into captivity by the Indians. Many of these, when they were, after long years, recaptured by the conquering Whites, were found to have grown so attached to the Indian mode of life, that they refused to quit their red companions; and actually had to be carried back to the settlements by force. Instances of this will be given further on in these pages.

These things are notorious, and American historical writers are unanimous in admitting it; but we have not been able to find a single instance where an Indian has adopted the white man's mode of life, except under compulsion:—"The Indian," says Mr. Parkman, "is a true child of the forest and the desert. The wastes and solitudes of Nature are his congenial home." *

The history of Australian and African exploration gives results practically identical, and shows that notwithstanding all its dangers, hardships, and uncertainties, the adventurous life of an explorer possesses extraordinary attractions. "Once an explorer (it has been said), always an explorer"—and in spite of years, and failing health, etc., we constantly find the same men venturing again and again upon fresh enterprises, until finally, in many cases, they have left their bones in the wilderness. It would be easy to quote quite a long list of such instances. Charles John Andersen, the well-known Swedish naturalist and traveller, for instance, lived for nearly a quarter of a century in his waggon in the

* *The Conspiracy of Pontiac*, by Francis Parkman, 1885, Vol. i, p. 1.

wilds of South Africa, and finally died * in the course of his journeyings through the desert, worn out by wounds and disease, and was buried in the pathless wilderness, no man knows where.

Then we have the case of Dr. Edward Schnitzer (Emin Pasha), the late renowned Austrian explorer and scientist, who, after being rescued from captivity by Mr. Stanley, though broken down in health and almost blind, insisted upon again returning, alone and unattended by white companions, to unknown regions in Central Africa, where, it is said on good authority, he was at last killed, and even eaten, together with his native followers, by the wild tribes whose territories he was traversing. †

In every part of the world, wherever an unexplored region exists, we find the same strange fascination seeming to attract the adventurer to renewed efforts, whether it be among the frozen regions of the icy seas, or the burning sands of the African or Australian deserts. Everywhere the attractions of the Wilderness seem to retain their constant hold upon the human mind, and to draw the wanderer, again and again, into revisiting them.

Nor can this predilection be regarded as unnatural, or one which ought to be censured. Scientifically speaking, it can hardly be doubtful that it has been

* He died of fever and dysentery, after wounds, in his waggon, in the Ovampo wilderness of South Africa, July 1867, and was buried in the desert, the natives refusing to allow the body to be interred near their Kraals. See p. 335, *Notes of Travel in South Africa* by C. J. Andersen (Edited, after his death, by L. Lloyd, with a biographical sketch).

† See London *Times* of Sept. 5, 1893: Account of Emin Pasha's murder, given on the authority of the missionary Mr. A. T. Swann, of the London Missions Staff.

inherited from our first parents, and that it is part of "the hunting instinct" which has descended from primeval times as part of man's savage nature. But it is not the worse for that—some of the finest traits in human character being likewise traceable to the same source. We see this hunting propensity illustrated every day in those "sporting tastes" which seem to be part of every man's nature, and which neither time, nor education, nor the restraints of business, nor the cares of family life have ever been able wholly to eradicate in any class of the community. They burn as strongly now, in the breast of the over-wrought miner or city factory-hand, as in that of the proudest lord of the soil or of the forest. Nor should this instinct be regarded as degrading by the moralist; for it is notorious that most of the world's greatest men have generally been among the keenest sportsmen. Even the great Napoleon solaced his exile in St. Helena by occasionally going out with a gun.* The captious critic, or the cynic, may affect to regard these things as "a relic of barbarism," or to ridicule them as silly romantic sentiment; but the fact will still remain that the youth who is insensible to the joys of the chase, or to the attractions of the field and the willow-margined stream, as well as to the grandeur of the ocean or the mountain, is seldom one destined to play a great part in the world's history.

The leaders of mankind have generally sprung from the ranks of the most high-spirited and adventurous

* See *History of the Captivity of Napoleon at St. Helena.* From the letters and journals of the late Lieut. Gen. Sir Hudson Lowe, and other official documents, by William Forsyth, 1853, Vol. iii, pp. 206, 211 and 217.

youths, most of whom have been distinguished for their love of field sports. As a conspicuous instance of this, we may cite the name of Washington.

It is impossible for the thoughtful man not to recognise the enormous influence which "the adventurer" has constantly exercised over the course of human events. The history of mankind in every age has constantly proved that the spirit of adventure burns strongly and fiercely within the human breast; and probably nowhere shall we find its influence more strongly marked than in the careers of those great men who have left behind them imperishable records, as illustrious "men of action." The early history of almost all those who have afterwards been distinguished as great rulers of mankind, or as great navigators, explorers, or prominent soldiers of fortune, has proved the truth of this maxim. Men may call it "ambition," or whatever else they please, but it is this spirit to do and dare beyond the range of common mortals, which has caused them to seek the bubble reputation of leaders in this band of adventurous men, some few of whom have thereby risen to fame and honour.

So also in the less obtrusive, but perhaps still nobler sphere of literary or scientific renown. The philosophers, of whom it may be said, that wherever in the world of letters science is looked up to, and learning is respected, there their names are known and honoured—all of them, in their own peculiar line, have been enthusiasts, imbued with the spirit of adventure, which has prompted them to seek in the hidden fields of learning the path that leads to glory.

The dull routine of existence, imposed by the

necessities of modern life upon the professional and mercantile classes, is, as we know, exceedingly distasteful to many young men. Hence it is that the more daring and ambitious spirits often resolve to break away from its restraints; and set forth, in constantly increasing numbers, to seek their fortunes in foreign lands, hoping there to find better openings for rising talent and industry, than in the overstocked markets at home.

The same restless impulse pervades no less strongly the rising generation of young men of independent means and fortune. The vain pomps and vanities of city life suit neither the tastes nor aspirations of many of these fiery spirits. It will be time enough to return to these things, so they think, when the heyday of youth is over, and after they have seen something of the great world of nature,—which is spread out beyond the seas for those that choose to seek it. Nor is it unreasonable that these youths should aspire to see something of its wonders, beauties, and romance, about which they have heard so much, provided their circumstances admit of it, before they settle down into quiet, stay-at-home, respectable old fogies.

Those of them who are men of sporting tastes find the exercise of their favourite pastime every day becoming more restricted and expensive at home—where, as we know, a small fortune may easily be spent upon deer forests, fisheries, or tracts of mixed shooting. Here, too, the net result is very often nothing but disappointment and vexation of spirit: for a man may pay for what are represented to be first rate sporting quarters, only to find that he does not get what he has paid for. He therefore comes to the conclusion that if he

wishes to save his pocket, and at the same time obtain better sport, the most thickly populated country in the world is hardly the place to look for it; and though "the great hunting days" are gone for ever, there can be no doubt that if a man desires to enjoy fairly good sport without having to pay extravagantly for it, he will do better abroad.

The careers of the traveller and sportsman are in fact so closely intermingled that it would be impossible to dissociate them. Whatever may be the intent with which a traveller may penetrate into the remoter and more thinly populated territories, he can hardly go far without having many opportunities of exercising his skill as a sportsman; and in the unpeopled wilderness, of course, he will be to a great extent dependent upon the produce of the chase for his daily sustenance. An indifferent hunter, in fact, is lacking one of the first qualifications requisite for a successful explorer.

Many of the most successful settlers in the "Far West," for instance, were adventurers, who began life as trappers, fur-hunters, or Indian traders. In fact, it was these hardy pioneers who gradually opened up those vast and fertile regions to the settlement of civilized man; and as we know, every one of this gallant band of daring spirits was a skilled hunter, and all were dead shots with the rifle, and thoroughly experienced in all the tricks and artifices of Indian warfare.

There is hardly a page of early American history that is not replete with exciting narratives of the daring courage of such men, and though the story of the white conquest of the Western World has been written upon by many, and has formed the subject of numerous

bulky volumes, it is one which nevertheless yet waits to have full justice done to it, until some great writer shall arise who, inspired by the majesty of the subject, shall be found capable of drawing with a master hand the picturesque details of this strange romantic history in all its dramatic completeness.

Few of us indeed at the present day at all realize how great an achievement the colonization of America was. Like that of all new countries, however, its early annals consist, almost entirely, of the history of the Traveller, the Explorer, and the Hunter; and if we study the circumstances attending the march of human progress, we shall find these sturdy adventurers have formed the vanguard of all great forward movements of the sort.

In these days a policy of foreign conquest is regarded as an unwarrantable outrage upon human liberty. That is as may be: but here it may be well to call attention to a remarkable feature characteristic of lands inhabited by savage races. Though everything points to the conclusion that these countries have been peopled by human beings from periods of enormous antiquity, no advance, as a rule, has ever been made in civilization until after the advent of the invader. The aboriginal tribes remained exactly what they had been for thousands of years during the past, and what, if left to themselves, they would in all probability have continued for thousands of years to come: thereby affording one more illustration of this strange yet undeniable fact, that in almost every part of the world the primeval races of the human family have proved to be deficient in some essential qualification which is necessary to enable them to raise themselves in the

social scale. The consequence is they have always remained, as in Africa, either in a state of unmitigated barbarism, or else, taken at their very best, they have advanced up to a certain point, but seem to be incapable of progressing beyond it.

The history of the oriental races furnishes a good illustration of nations coming under this second category.

In Asia, the reputed cradle of the human race, where the records relating to the early history of mankind are at present held to reach further back than in any other quarter of the globe, into the fringe of an unknown and boundless antiquity: its history is to this day, for the most part, that of the tented field, where the traveller is compelled to make his way through trackless plains and forests, or through mountain fastnesses, into almost unknown and inhospitable regions, inhabited by wild and hostile races, which the narrow policy of exclusion still endeavours to keep closed against the inroads of foreigners. Nearly all Central Asia remains in this condition to the present day.

Wherever, in portions of the great Asiatic continent, a civilized government has established those conditions which render progress possible, we owe it to the sturdy European adventurer, who, planting trading posts in the first instance, has subsequently, under the protection of his country's flag, displaced the native rulers, or compelled them by force of arms to submit to these elementary conditions of civilized society. The history of the British Empire in India is replete with such instances.

But, amid the busy whirl of modern life, where so

many subjects of interest and importance demand our attention, The Wilderness and its Tenants may perhaps appear to some to be one which from a practical point of view is too remote to be of much general interest.

Yet when we come to consider the matter a little more closely, we become aware that, taking the surface of the terrestrial globe as a whole, even now but little more than one half the habitable portion of it is more than nominally in the hands of civilized man —while the remainder (though of course in varying degrees) is either in the hands of semi-civilized, or of wholly uncivilized races.

The march of progress, and the innumerable demands created by a highly organized state of society, such as we have become accustomed to, makes the very idea of remaining stationary a matter of impossibility. So incessant are the changes that, as we know, new and useful inventions have in the present day sometimes become actually obsolete before they have had time to come into general notice. We can therefore hardly realize that, alongside of all this feverish haste and enterprise, there co-exists a condition of affairs where everything is diametrically the reverse of all this.

Yet, the moment we come to consider this question of "The Wilderness and its Tenants," we find that the thing which strikes us most forcibly is the changeless aspect of everything.

Here, nothing ever becomes obsolete or out of date. The hand of Nature has itself arranged the landscape, down to its minutest details—and as for the men whom the accident of birth has placed there, the self-same manners, customs, and dress, exist, so far as we can

judge, as they have existed it may be for hundreds, or even for thousands of years.

Take for instance the case of those changeless eastern races—the Arabs. No great stretch of imagination is required to conceive a caravan of these bronzed and bearded children of the wilderness, arriving and pitching their camp upon the brink of some desert watering place. The Arab patriarch, gazing down into its pellucid depths, can see in his own figure, reflected in its glassy surface, the stereotyped image of four thousand years ago—it might be of Abraham, as he once stood, when he tended his flocks upon these plains —a pilgrim, a wanderer, and a dweller in tents, as he and all his fathers were.

Passing, however, from these nomadic tribes to the consideration of the conditions of life as they still exist amongst the dwellers in cities throughout a great part of the semi-civilized communities, we shall find that it corresponds in a great degree to life in a species of permanent encampment. The unsettled state of society generally causes the inhabitants to remain closely cooped up within the boundaries of the town by night, from whence they can daily sally forth in security to look after their gardens or cultivated grounds in the vicinity. This is so in more than one European country at the present time; and in Eastern lands is generally the normal state of affairs.

When we pass beyond the limits of the town we quickly find almost every trace of human occupation cease, and thus we have brought home to our minds the true significance of the expression so often used in the New Testament, where the dwellers are represented as going forth from the great cities of Ancient

Palestine "into the wilderness," much as we in England might talk of going out for a walk in the fields.

In the present day such are the actual conditions of life in many of the cities of these countries. Immediately outside the walls are probably cemeteries, where in the open plain, from age to age, the ashes of successive generations of the inhabitants have been interred; marked in most cases, when marked at all, simply by rough stones set at the head and foot.* Beyond this rude city of the dead, seamed with numerous trails, worn by the feet of animals, which form the only highways of issue from the city, we very generally come upon a zone of cultivated gardens, encircling the walls for a more or less considerable distance.

If we follow one of these beaten trails towards the open country, we sometimes find the road passing between high banks on either side; but these cuttings have not been excavated by human labour; for roads in these countries have not been laid out by engineers or surveyors. They have been worn away by the feet of many generations of men and animals which have constantly passed along that same well-worn path, and thus, combined with the action of the winds and rains, in the course of ages these channels have been cut as they are now seen to exist.† In the old road leading from Jerusalem to Jericho, for example, we can still

* As a type of a city thus circumstanced we may cite the instance of Jerusalem, as seen *now*. Cairo in the same way is situated in the midst of a vast Necropolis.

† Deep travel-worn trails of this kind are common in many parts of India, but excellent examples of such sunken paths may be seen much nearer home, in the vicinity of the Field of Waterloo, where many of the cross roads and country lanes are thus sunk below the general level of the country.

trace throughout its whole extent the ancient trail, and even the very stones, over which it is probable that St. Paul, and even Christ Himself, travelled nearly 1900 years ago. But the rocky nature of the soil has in most places prevented its becoming deeply cut.

In wild countries the Wilderness often, indeed usually, comes up to the very walls of the city, within whose boundaries but too frequently there is nothing but decay; and on reaching the limits of the cultivated zone we at once enter the wild domain of Nature that extends beyond. In very many cases the thorny bush comes up to the very edge of the gardens, of which we have already spoken—and the track, if we continue to follow it, may lead us for miles and miles—it may be even for days—through an uninhabited region, till we reach the next city. If we diverge from the beaten path, for any distance to either side, we find ourselves immediately enveloped in the trackless waste, the haunts of wild beasts—that is "the Wilderness."

The rapidity with which the settlers of a civilized and powerful nation over-run the lands of savage races, and turn even the barren wilderness into fruitful plains, is well known. The hardy and adventurous spirits who act as their pioneers are, as we have said, mostly professional hunters and trappers, who quickly clear the country of the larger herds of game.

As agricultural and pastoral settlers begin to establish themselves, of course considerable numbers of wild animals of the larger kinds, in a state of nature, become incompatible with profitable agriculture. * Consequently

* Thus, we regret to state, the Boers in South Africa are killing all the game that remains. "It eats up the grass they want for their cattle," they say.

we always find that as the white man advances the great herds of game retire—and gradually disappear.

A remarkable instance of this is the well-known case of the bison, or buffalo, of the North American prairies, which is now practically extinct, except as a domestic animal—although at a comparatively recent date, during the lifetime of the present generation, they still roamed in incredible numbers throughout the vast territories of the Far West. The author himself has seen buffalo covering these plains in immense herds, extending in all directions to the most distant horizon—large bands of them appearing at times like great, brown, ploughed fields, in motion.—Yet now, the only representatives of this splendid animal are some two or three small herds captured as calves upon their native plains, existing as a species of semi-domestic cattle, in a state of confinement, from the hybrid descendants of which, crossed with the ordinary breeds of domestic cattle, great things are expected.

The fatal influence which the presence of the White man, and the use of firearms, was likely to have on the quantity of game frequenting a country was quickly recognized by those true children of the forest and the wilderness, the Red Indians.

The acute habits of observation habitual to this race of hunters, schooled from their infancy in the stern cradle of necessity, and dependent as they were, almost exclusively, for their very existence, upon the fruits of the chase, soon taught them to recognize in the "Pale Faces" their most insidious and deadly foes.

It is remarkable how early in the history of American colonization the Indians, with prophetic accuracy, seem

to have foretold the extermination of the Red man by the White.

Their efforts to deliver themselves from the presence of the dreaded invader naturally gave rise to most of the Indian wars, which have so constantly occurred in the history of American progress. The picturesque details of the last great struggle of the Red man for the supremacy of his race, which succeeded almost immediately after the British conquest of Canada in 1762 and 1763, are related by Francis Parkman in his interesting work "The Conspiracy of Pontiac," a book in many respects more interesting than any romance.

But before we pass to another branch of this subject, one brief anecdote illustrative of this prevailing presentiment among the Indians of the impending destruction of their race, may not be out of place.

At an early period of colonial history, the English honey bee was brought to America by the European settlers.* It had previously been unknown in North America; but once it became domesticated among the luxuriant flora of that exhaustless soil, it multiplied exceedingly, and swarms of it taking wing, quickly spread to westward, over the Indian hunting grounds. Here it became known to the Indians under the name of "*The White Man's Fly.*" The appearance of the honey bee was therefore held by them to be an evil omen—its advent being regarded as the precursor of the "Pale Faces." For, it was said—"As the honey bee comes and settles itself upon the flowers of the prairie and the forest, and drinks of their sweetness;

* The Honey Bee (*Apis Mellifica*) was introduced into America, at Boston, about the year 1670 (Haydn's *Dict. of Dates*, 28th Edit. 1892. Art. "Bee").

so shall the White man hereafter come to inherit the Indian's hunting grounds."

We are all aware of the tales of Indian cruelty and outrage, with which the records of frontier life in the American wilderness are filled—still it is impossible not to feel a certain sympathy with the misfortunes of this unhappy people, doomed by the inexorable decrees of fate to pass away like the buffalo, and to be driven forth from those fair and fertile lands, which were once their heritage; and the touching and eloquent appeal of the Indian Chief, when remonstrating with his white conquerors against the hardship of his lot in having to vacate his territory for the benefit of the invader, has many times been repeated in the works of American writers. "We were born," he exclaimed, "under the shadow of these trees; and our fathers' bones lie buried beneath them.—Shall we say to the bones of our forefathers, 'Arise and come with us into a foreign land'?"

It is true that the Indians were sometimes offered certain quantities of what were known as "Indian Trade Goods" in exchange for their lands, but as the Indians justly remarked, "Blankets and cloths soon grow old and wear out, but land lasts for ever."

The history of the Red man, his sorrows and troubles, and the wild, romantic incidents of his struggle for existence, which from generation to generation has been carried on, under the shadow of the primeval forest or upon the broad expanse of the Western prairies, may be taken as a type of the conflict of races, which has so often been repeated in every quarter of the globe—invariably with the same result.

Wheresoever the civilized man has met the "Tenants

of the Wilderness" and has disputed with them for possession of the land, the truth of the Darwinian theory of "the survival of the fittest" has established itself—by the civilized man displacing the aboriginal stock, whether of man or of animals, even down to many of the original flora of the country.

From the beginning of time this has been the universal law. It is not that Nature is partial in her dealings—by no means. The smiles and frowns of fortune are but a fiction of the poet's brain. If we interpret the provisions of her statutes rightly, we shall find that the unchangeable law of Nature has ordained that "life is an incessant warfare"—and in that fierce struggle for existence there is no such thing as standing aloof—we must fight, or die. There is no such thing as "quarter" to the vanquished. The strongest and the fittest conquers and survives, while the weaker falls and perishes—for the same reason that 10 pounds will weigh down 5 pounds—because it is the heaviest.

Is there then no other principle recognized in Nature than the rule of brute force?

Probably on this head all that can be safely said is that if we would avoid the penalties inevitably attached to a defiance of the laws of Nature, it can only be by obedience to the precepts taught us through the knowledge gained by means of her works.

And herein lies the true secret of the power of civilization. The light of science enables the civilized man to come nearer to this standard than the uncivilized man, and therefore he becomes the strongest and the fittest, and thus in "the warfare of life" he survives while the other perishes.

A paragraph in Mr. Froude's *Oceana* has a few well-chosen remarks upon this subject as follows——

"It is with the wild races of human beings, as with wild animals, and trees, and plants. Those only will survive, who can domesticate themselves into modern forms of social development. The lion, the leopard, the eagle and the hawk —every creature of earth or air which is wildly free, dies off, or disappears.—The sheep, the ox, the horse, the ass, accepts his bondage, and thrives, and multiplies.—So it is with man. The negro submits to the conditions, becomes useful and rises to a higher level. The Red Indian and the Maori pine away as in a cage, sink first into apathy and moral degradation, and then vanish." *

We propose to close this portion of our work with a chapter containing a number of passages selected from the works of great travellers and hunters, relating in each man's own words how deeply the attractions of "the Wilderness and its Tenants" (or in other words, "Wild Life, Wild Lands, and Wild Sports") have taken hold upon their affections.

As we have explained in our preface, we believe the idea of making a collection of this sort has never occurred to any previous author; the reader will, however, see for himself how strongly these opinions corroborate the views already expressed in our introductory pages, as to the valuable nature of the training which a short period of travel and residence in wild countries is calculated to have upon every intelligent mind.

We might extend the number of these extracts almost indefinitely, and it would be easy to cite many

* *Oceana, or England and Her Colonies*, by James Anthony Froude, 1886, p. 303.

cases where travellers, returning after such an experience, have frankly admitted that its effect had gone the length of influencing their whole subsequent careers; and all without exception look back to it ever afterwards as among the happiest and brightest periods of their existence. Nevertheless there may have been cases where the results have been less fortunate, but if so it is more than probable that the fault was with the individual—not with the wild graces of Nature.

The unanimous verdict of the experienced travellers whose opinions we append is that they at all events were each and all of them the better for it. The opinions of these experts, moreover, prove beyond question how strongly the charms of nomadic life appeal to the human heart; and perhaps it is not too much to say that in nearly every case (notwithstanding many counterbalancing circumstances, and certain undoubted drawbacks) the instinct has continued to burn fiercely within the breast of each of them, to the end of their earthly careers.

As regards the risk to health in making these expeditions, it would be wrong to minimize it. The reader will, however, be aware that a number of these gentlemen whose opinions we shall lay before him, passed successfully through their experiences; most of them attained to an honoured and respected old age; and the greater number of them died quietly in their beds, like other people, when the inevitable hour struck for them, as it must do for all of us. As a rule, however, weakly and delicate men should think well before exposing themselves to unwonted hardships and exertions, or to the influence of either great heat, or of cold, damp, or inclement weather. Nevertheless, both in dry hot,

and in dry cold countries, many have been changed from invalids into strong, hale, and hardy men. We have personally met, spoken to, and questioned such men literally by hundreds in our South African Colonies, in America, and elsewhere. These matters will, however, be referred to more particularly hereafter.

We have made it a point throughout these pages to insist, almost with obstinate iteration, upon what we conceive to be the necessary precautions which ought to be adopted by travellers in these matters, so that a sojourn in a wild country, whether it be long or short, which would otherwise, and in default of prudent precautions, inevitably prove a life of hardship and danger, may be made one of comparative ease and comfort, nay, even of luxury—for it should always be a maxim among travellers that no unnecessary hardship should ever be incurred.

The object should be to make oneself as far as possible at home in the wilderness, and he who makes his way through a difficult country with a minimum of expenditure of vital energy, is the best traveller.

That being so, "the pushing trader" will, we fear, often find the suggestions offered in these pages either unpalatable or unpracticable in his case.

To rush through a country at more than express speed, as fast as the legs of horses, etc., can be got to carry him, is a practice with which we must admit we have little sympathy—and it must be obvious our remarks are addressed to quite a different class of readers. At the same time, it may be all quite right, and even laudable, for a business man to hurry over the ground as quickly as he can; in order that he may get ahead of competitors, and make money for him-

self and those dependent on him, as fast as possible. That goes without saying—and in such cases we are well aware that "Time is Money." All that we desire to do is to guard ourselves against the objections which the "Commercial Traveller" may find with what we have to say to the man of leisure, the man of science, the sportsman, or the invalid.

It is comprised in a few brief sentences: Never over-do things.—Travel from place to place slowly, rather than rapidly.—Make yourself as comfortable as you can.—Make yourself, in short, at home in the wilderness.

But above all, observe! and make a note of what you see at once, for the human mind is but a fallible guide when recollection alone is trusted to.

Habits of observation stand first on the list of qualifications necessary to make a successful traveller, but to give the data thus collected their utmost value, sleep should seldom seal the eyes of the wayfarer before a brief precis of the day's work has been jotted down.

CHAPTER II.

RETROSPECTS OF THE EXPERIENCES OF CELEBRATED TRAVELLERS AND HUNTERS.

Opinions of Captain Cornwallis Harris. Mr. Charles John Andersen. Mr. Gordon Cumming. Sir Samuel Baker. Mr. Walter M. Kerr. Colonel Parker Gilmore. Major H. A. Levison. The Hon. James Inglis. Mr. Charles Darwin. Dr. Georg Schweinfurth. Mr. Richard Ford.

BEFORE entering upon the consideration of other matters, it may not be amiss to place before the reader some short extracts culled from the pages of different authors, whose works contain paragraphs testifying as to the feelings with which they look back upon their career in the capacity either of travellers or hunters.

These authors were most of them remarkable men in their day and in their respective spheres, in one or other of these capacities.

Captain Cornwallis Harris (Bombay Engineers) H.E.I.C.S.

"To all others I prefer a life of adventure, its very privations constituting an excitement adapted to my humour"—"There was something soul-stirring and romantic in wandering among these free-born denizens of the desert; realizing as it were a new creation in regions hitherto seldom, if ever, trodden by white man's foot"—"But in spite of all hardships and privations, toilsome and tedious as our journey frequently was, across deserts of utterly hopeless sterility, we were more than amply repaid by the unparalleled magnificence of the

sport we enjoyed, and I can safely aver that some of the happiest days of my existence have been passed in the wilds of Africa. They form a passage in my life which time can never efface from the tablet of my recollection—a green spot in memory's waste, to which in after years I shall ever revert to with intense and unabating pleasure." *

Charles John Andersen (Swedish Traveller, Explorer, and Naturalist).

(Writing of himself in the third person.)

—"It is more than probable that his career as an explorer and pioneer to civilization and commerce, is terminated. Still he would fain hope his humble exertions may not be without their fruits. When he first arrived in Africa, he generally travelled on foot, regardless of the heat. Indeed, he was wont to vie with the natives in endurance—but now, owing to the severe hardships he has undergone, his constitution is undermined, and the foundation of a malady laid, that it is feared he will carry with him till his death. Yet such is the perseverance of human nature, that did circumstances permit, he would return to this life of trial and privation." †

(*And so he did return*, and passed, as we have already stated, some twenty-five years of his life travelling in Africa, and finally died and was buried in the wilderness, July 5, 1867.) §

Roualeyn Gordon Cumming of Altyre (African Traveller and Hunter).

"During the many years I spent in the wilderness, my waggon was my only home. Even this I often deserted,

* *Wild Sports of Southern Africa* (in 1836 and '37), by Captain Cornwallis Harris, 3rd Edit., 1841, pp. 284-5.

† *Lake Ngami, or Explorations and Discoveries during Four Years' Wandering in the Wilds of South-Western Africa*, by Charles John Andersen, 2nd Edit., 1856—concluding paragraph of Preface, p. v.

§ See, *Notes of Travel in South Africa*, by C. J. Andersen. Edited after his death by L. Lloyd, 1875, p. 335.

and alone, or attended by savages, proceeded on distant hunting expeditions, leaving my few followers encamped round my luggage. Days and nights have I passed in my solitary hunting hole, near some drinking place, watching the majestic carriage of the lion, the sagacious actions of the elephant, and the curious instincts of the countless varieties of game that have passed within a few yards of me, unaware of the proximity of man." *

"As I rode along, in the intense excitement of the chase I felt a glad feeling of unrestrained freedom, which was common to me during my career in Africa, and notwithstanding the many days and nights of toil and hardship which I afterwards encountered, I shall ever refer to those times as by far the brightest and happiest of my life." †

Sir Samuel Baker (Traveller, Hunter and Explorer).

(One of the discoverers of the sources of the Nile and afterwards appointed, Feb. 1870, Governor-General of the Soudan by Ismaïl Pasha, Khedive of Egypt).

"The Bivouac in the wilderness has many charms, there is a complete independence. The sentries are posted, and the animals picketed and fed, and the fires arranged in a complete circle around the entire party, men, animals, and luggage, all being within the fiery ring—the sentries alone being on the outside." §

"There is a peculiar delight, which passes all description, in feeling thoroughly well-strung, mentally and physically, with a good rifle in your hand, stalking quietly through a fine country, on the look-out for *anything*—no matter what." **

* *Five Years of a Hunter's Life* (1843 to 1848) *in the Far Interior of South Africa*, by Roualeyn Gordon Cumming of Altyre, 1850, Vol. i —concluding paragraph of Preface.

† *Ibid.* Vol. i, p. 63.

§ *The Albert Nyanza*, by Sir Samuel W. Baker, 1866.

** *Eight Years in Ceylon*, by Sir S. W. Baker, 1855.

"These days will always be looked back to by me with the greatest pleasure, and when the limbs become enfeebled by time, the mind can still cling to scenes long past, with the pleasure of youth." *

Mr. Walter M. Kerr, C.E. (Traveller and Explorer).

"To me there has always been, and I suppose ever will be, a pronounced fascination in the circumstances of a genuine wild life, far away, in the core of some marvellous region, whose land has rarely been trodden by the foot of civilized man, and whose story is unrevealed." †

Colonel Parker Gilmore (Traveller, Explorer, and Hunter).

"Despite the dangers and hardships, a hunter's life, particularly in the interior of Africa, has a wonderful attraction for some people: in fact it asserts such a magnetic influence over many that, having once enjoyed it, ever after they have an irresistible craving to resume it." §

Major H. A. Levison (Traveller, Explorer, and Hunter).

"Bred up as a soldier and a hunter, since my boyhood, I have been a wanderer over the face of the earth; leading what some of my friends may term a vagabond life, which I do not feel inclined to change, even now that the future looks small in comparison with the past." **

The Hon. James Inglis (Indian Hunter and Sportsman).

"In very truth, I at all events can say that having come through many and varied experiences, having sounded nearly every note of a busy life's vicissitudes, I look back to my happy days of tent life, as a planter and pioneer of settlement, with the most unalloyed feelings of satisfaction, and with a

* *The Rifle and Hound in Ceylon*, by Sir S. W. Baker, 1854.
† *The Far Interior* (of Africa) by W. M. Kerr, C.E., 1886.
§ *Days and Nights by the Desert*, by Parker Gilmore, 1887.
** *The Old Shekarry*, by Major H. A. Levison, 1866.

supreme longing that I could live them all over again." *

The foregoing represent the feelings and opinions of well-known hunters and travellers, but if we now quote the impressions of a differently constituted mind, we find the philosopher and man of science not one whit less susceptible than other men to the solemn grandeur of the wilderness, and in the midst of a life devoted to laborious study, he pauses to add his tribute of admiration:

Mr. Charles Robert Darwin (Philosopher, Naturalist, etc., etc.)

"It has been said that the love of the chase is an inherent delight in man, a relic of an instinctive passion. If so, I am sure the pleasure of living in the open air, with the sky for a roof, and the ground for a table, is part of the same feeling: it is the savage returning to his wild and native habits. I always look back to our boat journeys, and my land journeys, when through unfrequented countries, with an extreme delight, which no scenes of civilization could have created. I do not doubt that every traveller must remember the glowing sense of happiness which he experienced when he first breathed in a foreign clime, where the civilized man had seldom or never trod." †—"It is impossible (says a biographical sketch of him) to overrate the influence of the voyages (in H. M. S. Beagle) on Darwin's career.—He left England untried and almost uneducated for science.—He returned a successful collector, a practised and brilliant geologist, and with a wide knowledge of zoology—and above all, he came back full of the thoughts on evolution, etc." §

* *Tent Life in Tiger Land*, Twelve Years' Reminiscences by the Hon. James Inglis, 1889.

† *Journal of Researches into the Natural History and Geology of the Countries Visited during the Voyage of H.M.S. Eeagle Round the World* (1831 to 1836), by Charles Darwin, Edit. of 1879, p. 505.

§ *Dictionary of National Biography*, Edited by Leslie Stephen, Vol. xiv, p. 74.

There can be no doubt that the foundations of Darwin's great career were laid as the direct result of his experience of life in the wilderness by land and sea, during which he was constantly studying the phenomena of Nature as there witnessed by him. This makes good what we have already said as to the value of such experiences on the future life of the intelligent traveller. It also will be interesting to note the objects which seem to have made a particular impression upon the mind of the learned Darwin during the period of nearly five years, over which his travels extended. He tells us—

"Of individual objects perhaps nothing is more certain to create astonishment than the first sight in his native haunts, of a barbarian—of man in his lowest and most savage state. I do not believe it is possible to describe, or paint, the difference between savage and civilized man."

Presently he goes on to say—"Among the scenes which are deeply impressed on my mind, none exceed in sublimity the primeval forests, undefaced by the hand of man; whether those of Brazil, where the powers of Life are predominant, or those of Tierra del Fuego, where Death and Decay prevail. Both are temples of the God of Nature:—no one can stand in these solitudes unmoved and not feel that there is more in man than the mere breath of his body. In calling up the images of the past, I find that the plains of Patagonia frequently cross before my eyes; yet these plains are pronounced by all, wretched and useless. They can be described only by negative characters; without habitations, without water, without trees, without mountains, they support merely a few dwarf plants. Why then, and the case is not peculiar to myself, have these arid wastes taken so firm a hold on my memory?" *

* *Journal of Researches*, etc., p. 503.

With respect to the special qualifications which Mr. Darwin thinks most desirable in a traveller, he considers that, "A traveller should be a botanist, for in all views plants form the chief embellishment." *

While absorbed in the close study of every species of object of scientific interest, the Great Naturalist was nevertheless profoundly impressed with the wild beauty of creation, as seen by him throughout his journeys, especially so with the splendour of tropical scenery and vegetation. We shall therefore offer no apology for reproducing one such picture of this kind, bequeathed to posterity by Mr. Darwin in his Journals:—

"It must be remembered that within the tropics, the wild luxuriance of Nature is not lost, even in the vicinity of large cities; for the natural vegetation of the hedges and hill-sides overpowers in picturesque effect the artificial labour of man."

"It is a hopeless attempt to paint the general effect."

"Learned naturalists describe these scenes of the tropics by naming a multitude of objects. But who from seeing a plant in a herbarium can imagine the appearance when growing in its native soil? Who from seeing choice plants in a hot-house can magnify some into the dimensions of forest trees, and crowd others into an entangled jungle? Who, when examining in the cabinet of the entomologist the gay exotic butterflies and singular cicadas, will associate with these lifeless objects the ceaseless harsh music of the latter, and the lazy flight of the former—the sure accompaniments of the still glowing noon-day of the tropics? It is when the sun has attained its greatest height that such scenes should be viewed: then the dense splendid foliage of the mango hides the ground with its darkest shade, whilst the upper branches are rendered, from the profusion of light, of the most brilliant green."

* *Journal of Researches*, etc., p. 603.

"When walking quietly along the shady pathways, and admiring each successive view, I wished to find language to express my ideas. Epithet after epithet was found too weak to convey to those who have not visited the intertropical regions, the sensations of delight which the mind experiences."

"How great would be the desire in every admirer of Nature to behold, if such were possible, the scenery of another planet!—Yet to every person in Europe it may be truly said that at the distance of only a few degrees from his native soil, the glories of another world are opened to him. In my last walk I stopped again and again to gaze on these beauties, and endeavoured to fix in my mind for ever an impression which I knew sooner or later must fail. The form of the orange tree, the cocoa nut, the palm, the mango, the tree fern, and the banana, will remain clear and separate; but the thousand beauties which unite these into one perfect scene, must fade away. Yet they will leave, like a tale heard in childhood, a picture full of indistinct but most beautiful figures." (Description of scenery at Bahia, Brazil, and reflections thereon). *

Dr. Georg Schweinfurth (German Traveller and Explorer, Scientific Botanist and Artist).

"Already have I expressed my happiness at having reached the object of my cherished hopes—my satisfaction at thus finding life to be with me an idyll of African Nature.—My health was unimpaired, and never before had I been less hindered in prosecuting my pursuits. I was left alone in the temple of creation. The people around me were somewhat embarrassing, but it did not much disturb the inner repose of this still life. In sickness everything is sad, and the craving for home is not to be suppressed; but whoever, in the robustness of health, can imbibe the fresh animation of the wilderness will find that it stamps something of its unchanging verdure

* *Journal of Researches*, etc., by Chas. Darwin, Extracts from pp. 495 to 497.

upon his memory; his imagination will elevate it to a paradise, and the days spent there, will enroll themselves among the very happiest of his life." *

Mr. Richard Ford (English Traveller and Historical Writer).

"The pleasures of travelling are cheaply purchased by trifling inconveniences, which may always be much lessened by forethought. The expeditions teem with incident, adventure, novelty, and means of obtaining insight into human nature; and form in after-life a perpetual fund of interesting recollection: All that was charming will then be remembered, and the disagreeable, if not forgotten, will be disarmed of its sting." †

* *The Heart of Africa*, by Dr. Georg Schweinfurth, 1874, Vol. i., p. 224.

† *Gatherings from Spain*, by Richard Ford, 1846.

CHAPTER III.

GENERAL OBSERVATIONS UPON "THE CLIMATIC ZONES."

Decisive Influence of Climate upon Fauna and Flora. "Heat" and "Moisture" as Factors in Climate. Boundaries of Climatic Zones subject to Variations. Difficulties in defining the Limits of Deserts. Limits of the Ice Pack on the Ocean constantly shifting. Variations of Climate between the Regions East and West of the Andes in South America. The Theory of Climatic Zones not new. Nature and Artificial Management of Land. Vegetation destroying the Works of Man. Sand Drifts on Deserts, burying Cities and Temples. The Primeval Forests of Britain. The Great Cities of Antiquity as Deserted Ruins. Metaphor of "The Spider's Web" of an Ancient Persian Poet. Scriptural Description of a Ruined City. Land reverting to "A State of Nature." The Climatic Charts of Physical Geographers. The Evergreen Band of Equatorial Forest. The Great Prairie or Steppe Regions. Tendency of Soil to revert to its Primeval Condition. Flora as a Clue to Climate. The Cocoa-nut. The Date Palm. Characteristics of Climate determinable from a Collection of its Plants. But Geographical Position no sure Guide to Flora. Deflection of Isothermal Lines on Climatic Charts. Climates of Great Britain and Labrador contrasted. Table of Madden's Climatic Zones and Their Respective Boundaries. Table of Special Regions.

WHEN a traveller is about to visit a strange land, the very first question which he asks himself will naturally be: "What is the character of its climate?" because the nature of his outfit, and the whole of his subsequent arrangements will necessarily depend upon that. So also, while investigating the phenomena of Nature, we shall find almost every detail of the landscape governed by the same considerations: the character of the trees, plants, and animals, seen in it, will of course, all be dependent upon the climate.

That being so, we need offer no further apology for

placing a general survey of climate in the forefront of our work—and in opening this branch of our subject, it may be desirable to commence with a short explanation of what are called "The Climatic Zones."

The two great factors in the regulation of climates, briefly stated, may be regarded as heat, and moisture. These attain their maximum at the equator. The equatorial regions, therefore, have the highest *mean* temperature of any part of the earth, and also, as we shall presently show, the heaviest rainfall. Sometimes this zone is spoken of by geographers as the Region of Perpetual Rains, because for some distance on each side of the equator heavy rains occur at short intervals throughout the whole year. Beyond that again, both to the northwards and southwards, we come to regions where the rains become intermittent; part of the year being dry and hot, and the remainder subject to periodic wet seasons.

Here we locate other zones, and so on, to denote every well-marked change of climate that occurs, until we reach the Polar regions, of almost perpetual cold.

It goes almost without saying, however, that there are no fixed limits at which hard and fast lines can be drawn round the earth, marking the exact points where each substantial change of climate occurs. Climates as we know, are variable, so that even in the same district, they differ materially one year with another. So also the boundaries of Climatic Zones, wheresoever they may be placed, are apt to shift from time to time, rendering it impossible to say with certainty *exactly* where such zones begin or end. A good example of this is to be found in the limits of "The Desert Zone."

Prima facie, it would seem that it ought to be very easy to see where a desert begins, or where it comes to an end; and yet it is not so: as a matter of actual fact, it is one of the most difficult things possible to lay down a limit to the desert that will stand the test of criticism; and for this reason, that the almost rainless zone, which forms the desert, is periodically visited by rain storms of extreme violence, as well as by more moderate showers which produce a season of verdant growth, however short it may be, so that the limits of the desert are constantly shifting backwards and forwards. What is at one period of the year an expanse of absolutely sterile sand or clay, at another time is covered with verdure, and cattle may be pastured upon it.

In fixing the limits of the desert, or any other zone, therefore, all that we aspire to do is to show the approximate mean limits to which, as we humbly conceive, the desert may be taken to extend.

But we cannot too emphatically point out that there exists no hard and fast line anywhere in Nature, exactly circumscribing the geographical limits of any of her productions: all her transformations are gradual, and pass one into the other so imperceptibly that no absolute line of demarcation is visible. If we take any of the phenomena of Nature, and carefully examine its conditions, we shall find this the invariable rule. Take a well-known case, such as that of the limits of the Polar ice: Arctic navigators are well aware that these limits are continually shifting; some years the sea is open much farther towards the pole; while at other times the ice extends a long way further out into the ocean than it did the previous year. When

therefore the geographer draws upon his map an ideal line, marking the equatorial margin of the Polar ice, it is well understood to signify that such is merely its approximate mean limit during ordinary seasons, and that it by no means presumes to fix an invariable line from which the great ice movements never deviate one way or the other.

The boundaries which we have ventured to fix to each of our Climatic Zones are therefore to be understood to be subject to similar conditions. In each case we have been careful to set forth the reasons which have seemed to warrant our decision, and also to explain, as far as that has been possible, the causes which produce exceptional climatic conditions in particular regions; as for instance in South America: Why should large portions of the western seaboard be practically a rainless and treeless desert, while upon the same parallel of latitude, upon its eastern and central portions, there is a tremendous rainfall, and the land is covered by impenetrable forests of the most luxuriant growth? The reasons for this will be apparent when we come to consider this question. Fortunately, in this case, the causes of these wonderful differences of climate are so manifest as to be accepted by geographers in general as furnishing a complete explanation of this wonderful phenomenon. The matter is merely referred to at present, however, with a view to show that exceptional causes are apt to produce exceptional effects in every part of the world, which of course still further complicates the difficulty of saying what are the limits of, say, the Desert Zone, with any certainty in any part of the world.

The theory of Climatic Zones, though by no means a new one, has in consequence been abandoned by many geographers, as too uncertain to warrant its general adoption.

And yet, when all is said and done, we hold it to be impossible to close one's eyes to the fact that a certain class of country *does*, in effect, form a belt round the earth's circumference, with more or less continuity almost everywhere. Nevertheless the theory of Climatic Zones has failed to obtain general acceptance, because, as we humbly conceive, its advocates have tried to prove too much, and desired to parcel out the earth's surface into too great a number of regions, differing from each other in too slight a degree to be generally accepted among men regarding things from different points of view.

Let us take a single instance of a belt such as we have described: and we ask any thoughtful geographer, is it not a fact that at the equator the earth's terrestrial surface is circumscribed almost everywhere by an evergreen forest of trees, which forms a dense and almost impenetrable girdle around it at that point? It is true that through human agency this forest has been destroyed at certain places near the Equator, and that meadows and open country in consequence, at present exist in these spots; but if so, the moment that these lands are suffered to run wild, even for a comparatively very short space of time, young trees and bushes spring up with inconceivable rapidity, and reassert the title of the wilderness.

This is the reason why we have chosen the Wilderness as the type of country which we purpose to write about: because there the natural landscape

is seen as Nature intended it to be seen, before it was diverted to other purposes foreign to her design.

It is a remarkable fact how Nature resents these changes. Man may continue steadily working for ages, without limitation, to maintain a piece of ground in a certain condition to suit his own purpose. Yet the moment he gives up the contest Nature at once proceeds to reassert her indefeasible title to the land, and one after the other his works begin to dwindle away and decay, until finally they are entirely effaced. Future generations of travellers making their way across the country find the wilderness again in full possession of the disputed territory; if it was a forest country, the tree growth has again occupied the scenes of man's labours and aspirations, seeds have germinated, and their roots have fixed themselves upon his mouldering walls and have overturned his most massive architectural monuments, destroying them in many cases so completely that it is sometimes impossible even to trace with any degree of certainty their original limits or design. The beast of prey and the night-bird make their lairs in what were the habitations of mankind.

So again, if it was a desert land and man has reclaimed certain areas of ground from the sand, and planted upon it his cities and his temples, feeding the thirsty soil with water brought thither by construction of canals or other means; if in the vicissitudes of time the human population become dispersed: the sand-drift will infallibly seize its own again, and in the course of years will bury every trace of human occupancy under the onward movement of its sand-waves. Nu-

merous and striking illustrations of this are to be seen in Egypt and elsewhere.

Arguing from analogy, therefore, we can have no doubt that if the population of Great Britain from any cause were to disappear, the country which is situated in the Great Forest region of the Temperate Zone would gradually resume the condition of a great forest—what history teaches us it actually was in ancient times. It might be supposed that with its superabundant population and advanced civilization this would be impossible. But as we know, the world contains numerous instances of mighty nations, possessing an advanced civilization (as the remains of their ancient works of art and architectural monuments most clearly show) which have disappeared so completely that their very name and language have now passed into oblivion.

There are places where the country is covered, for many square miles, with traces of a former superabundant population, including the ancient sites of great cities, containing remains of magnificent temples, palaces, and other extensive works, representing an enormous expenditure of human skill and labour; where the wilderness has so completely resumed its sway that the whole district is now covered with almost impenetrable forest, inhabited only by a few wandering families of wild jungle people.

These spectacles of fallen greatness and departed glory are eloquent and solemn object lessons to mankind, and exhibit in the most striking manner the instability of human institutions. Their transitory splendour, when contrasted with their present utter desolation and loneliness, has been very beautifully

expressed, in the figurative language of the East, by an epic poet of great renown in ancient Persia, in these striking lines:

"The spider spins her web in the palace of Cæsar!" *
"The owl stands sentinel upon the watch-tower of Afrasiab!" †

The same metaphor of the spider, silently weaving her web in the palaces of the great, unheedful of the vain pomp of regal magnificence, has, however, been thus employed in the Book of Proverbs, of Solomon the King, more than 1600 years before the Christian Era:

"The spider taketh hold with her hands, and is in Kings' palaces." §

The picture of desolation presented by these ruined cities, wherein wild beasts have made their dens and rear their cubs upon the hearth-stone where women used to rock their infants' cradles, while troops of merry children romped and played in the now deserted streets, has been painted with great dramatic force and beauty in many passages of the Scripture, notably in the Book of the Prophet Isaiah. Before we pass to the consideration of other matters we shall take the liberty of reproducing one of these picturesque descriptions:

* Literally in the original Persian, "*The spider holds the veil*," in allusion to the creature holding the gossamer threads with her feet (See Sir William Jones's Persian Grammar, Edition of 1809, p. 106).

† From "*Shahmamah*" or *The Book of Kings*, by Abu'l Kasim Mansúr—commonly known under the *Nom de Plume* of "Firdousi"—a Persian poet, who lived about A.D. 322 to 411. [*Afrasiab* was a king of Turan (now Turkestan) who invaded and took Persia, *about* 600 B.C., according to the ancient mythological records of that country].—(See the *History of Persia*, by Major-General Sir John Malcolm, governor of Bombay, published 1829, Vol. i, Chap. ii—also Appendix to *Ibid* Vol. i, pp. 538—540.—See also *Encycl. Brit.*, 9th edit., Vol. ix, pp. 225—227, Article "Firdousi" among other authorities.

§ *Proverbs* xxx, verse 29.

"But the cormorant and the bittern shall possess it; the owl also and the raven shall dwell in it." *

"And thorns shall come up in her palaces, nettles and brambles in the fortresses thereof: and it shall be a habitation of dragons, and a court for owls. The wild beasts of the desert shall also meet with the wild beasts of the island, and the satyr shall cry to his fellows; the screech-owl also shall rest there, and find for herself a place of rest. There shall the great owl make her nest, and lay, and hatch, and gather under her shadow: there shall the vultures also be gathered, everyone with her mate." †

This falling back of the sites of populous cities and cultivated grounds into what is called a state of Nature furnishes the strongest evidence of the existence of a permanent characteristic tendency inherent in land to revert to its original condition, whatever that may have been. If it was a forest region the tendency, therefore, is for trees to spring up spontaneously; if it was a heathy moorland, the tendency is for the soil to produce heather; though every trace of heather may have been extirpated by generations of steady, continuous tillage.

These things can hardly fail to produce a deep impression upon every thoughtful mind, and seem to point to the conclusion that Nature has aplotted the earth's surface into special regions, such as the forest, the prairie, or the desert; and taking the map of the world in one's hand, anybody possessing a fair knowledge of physical geography can see that these special regions seem to extend in a more or less continuous way, in the form of bands encircling the earth's ter-

† Isaiah xxxiv, part of verse 2.
§ *Ibid.* xxxiv, verses 13, 14, and 15.

restrial surface. These form what we have ventured to call "The Climatic Zones." Some of them are marked with exceeding distinctness. Notably, for example, "The Great Forest Region of the Equatorial Zone," of which we have already spoken. Again, take the prairie, or Steppe Region: see the vast extent of these treeless plains in North America, and again in the same parallel of latitude, right across the great continent of Asia, and across parts, at all events, of that of Europe—notably, for instance, in Southern Russia. Then again these great plains reappear in a similar position in the southern hemisphere, in the pampas of South America, and in the karroo and grass veld of Southern Africa, though on account of the great preponderance of ocean in that hemisphere, their extent is very much smaller than in the northern hemisphere.

So we might go on to show that, save and except in certain exceptional districts, the whole earth is thus laid out substantially in a series of climatic bands or zones throughout its entire terrestrial extent; and again, wherever exceptional regions do extend, forming a breach in their continuity, in almost every case there are evident reasons which make it apparent why they should occur where we find them.

Moreover, these very exceptions to the general law are in themselves in a pre-eminent degree suggestive and instructive; and show in terms that speak louder and clearer than any words could do, that all these variations in the nature of a country depend upon climate. The two great factors in climate, as we have said, are heat and moisture. Where there is a damp atmosphere, the tendency is to produce arborescent

growths; where the moisture is excessive, conditions of soil being suitable, the tendency is to produce heavy forest growths; where the rains are followed by a long dry period, the tendency is to produce stunted trees, or bush and jungle; where the winds are dry, and the rains variable, the tendency is to produce treeless plains with herbage only; where winds are dry and rains wanting, a desert of course occurs. Such in brief are the principal conditions which operate, as we humbly venture to assert, to create the great system of climatic zones. It may, however, be objected that the division of these zones is really a botanical rather than a climatic one: that is so to a great extent, because the truest test of climate is vegetation.

Tell a botanist what plants grow in a given district, and he will tell you what its climate and mean temperature should be, and whether it has a dry or a moisture-laden atmosphere.—Let us take the cocoa-nut (*Cocos Nucifera*) as an example. If this tree grew there, the climate must have been equatorial, the atmosphere was hot, moist and equable, and the elevation above sea-level did not exceed 2000 feet: that being so the locality was probably near the sea board, because the cocoa-nut is a sea-loving plant, very sensitive to changes of temperature, so that on the inland highlands where the temperature is subject to variations, the tree could not survive. Or again, take the date palm (*Phoenix Dactylifera*); if that tree was found there, it was the Desert Zone, with an extremely dry atmosphere, with powerful suns, and an almost rainless climate; but the subsoil contained water, and a pit sunk near its foot would have found water, perhaps of a brackish or salinous quality, but still

water of some kind at no great distance beneath the surface. And so a skilled botanist would really be able to tell more about the climate of a place, which he had never seen, on being shown a collection of its plants, than a careless or ill-educated observer, who had resided for a considerable time in the locality: just as a skilled anatomist will construct a close imitation of the whole frame of an extinct animal, on seeing a single important bone which formed part of its body.

But though the botanist can form an excellent idea respecting climate, etc., from the study of flora; an attempt to guess at the probable character of flora, from the geographical position of a country, might lead to very erroneous conclusions, because the latitude of a place by no means always governs its climate; as it might, *prima facie*, be expected to do.

On turning to the climatic chart of any atlas of physical geography, the examination of it will show that its isothermal lines are here and there curved out of their regular course, on account of being deflected by various local causes. The causes of these variations involve technical questions which will be dealt with as they arise in the course of this work; it will be sufficient for the present to cite the marked deflection of the isotherms over the British Islands, compared with those over Labrador, as a notable instance in point. These wide differences in their mean temperatures are created, as it is now almost universally admitted, by the set of ocean currents. Thus, the British Islands are fully exposed to the influence of the "Gulf Stream," which carries a current of warm water directly upon our coasts; whereas, as the chart of ocean currents

shows, the coasts of Labrador are bathed by an icy stream, known as "The Hudson Bay Current,"* descending from the arctic regions. These extensive streams of warm and cold water, respectively, either raise or lower the temperature of the air in their vicinity, and thus produce great variations of climate between these countries situated within nearly the same parallels of latitude, which under the circumstances is not much to be wondered at.

So again in almost every instance, where sharp curves of the isotherms warn us of marked abnormal increase or diminution in the temperature of a particular region, local causes are apparent, which furnish very good reasons why such peculiarities should occur. It would, however, be out of place to enter into details respecting these phenomena in a preliminary and explanatory chapter upon the Climatic Zones generally; and we shall close these remarks by giving a table in which the name and locality of each of them is clearly indicated, which will give our readers a general idea of our system.

The Climatic Zones, which girdle the earth, both by land and sea, are six in number; and occur in corresponding positions in both hemispheres: there are therefore two examples of each; one to the north, and the other to the south of the equator.

We have ventured to fix their position and boundaries (beginning from the equator), respectively, as follows:

1. THE GREAT FOREST REGION OF THE EQUATORIAL ZONE.

* See, *The Royal Atlas of Modern Geography* by Alexander Keith Johnson, Map 2, Chart of the World on Mercator's Projection Showing the Direction of the Ocean Currents.

This region comprises two belts of country, each extending 15° from the Equator to the parallels of Lat. 15° North and Lat. 15° South.

2. THE GREAT BUSH COUNTRY (OR JUNGLE REGION).

This comprises two other belts, beginning at Lat. 15° N. and Lat. 15° S., and extending to the 25th parallels of North and South Latitude.

3. THE DESERT ZONE.

Comprising two belts extending from the 25th to the 30th parallels.

4. THE REGION OF THE GREAT PLAINS (THE GREAT GRASS COUNTRY).

Comprising two belts extending from the 30th to the 50th parallels.

5. THE GREAT FOREST REGION OF THE TEMPERATE ZONE.

Comprising two belts extending from the 50th parallel to the circumpolar circles (Lat. 66° 32′).

6. THE ARCTIC AND ANTARCTIC ZONES.

Extending from the circumpolar circles—Lat. 66° 32′ North and South—to the Poles.

To these we must add three additional sections, relative to special regions, which occur at different parts of the earth's surface throughout each of the six pairs of climatic zones, *viz.*:

THE GREAT MOUNTAIN REGIONS.

THE GREAT RIVER SYSTEMS.

THE GREAT TERRESTRIAL RESERVOIR: THE OCEAN.

Each of these last-named important sub-divisions, as we shall presently have occasion to show, exercises a vast influence upon the whole expanse of the ter-

restrial globe—influences which by no means cease to play their part in the great economy of Nature when we pass beyond the apparent limits of these regions. When the mountains, for instance, sink down into the plain, their climatic influence still extends over a vast expanse of low-lands. When the rivers mingle with the ocean, they are not lost. And though the Creator has set bounds to the sea which its waves cannot overpass, new rivers rise from its surface and are carried by the winds back to the mountain slopes from whence they took their sources.

CHAPTER IV.

TERRESTRIAL CLIMATES, TEMPERATURES, AND ATMOSPHERIC DISTURBANCES.

Value of a Knowledge of Climate to Travellers. Ignorance that formerly Prevailed on this Subject. Examples from British Military and Colonial Records. In the Worst Climate there is a Comparatively Healthy Season. Slight Losses in Recent Expeditions, due to Going in the Healthy Season. The Walcheren Expedition, Causes of the Great Losses. Principal Factors in the Creation of Climate. Temperature as Modified by Elevation. General Contour of the Earth's Surface. Ratio of Temperature to Elevation. Mean Temperature of the Equatorial Zone. Swampy and Unhealthy Coasts. The Highlands of the Interior. Tropical Sanitary Stations. Climate of Mexico. Beauty and Luxuriance of Its Forest Scenes. The Tropical Rains. Yellow Fever. Sanatorium of Jalapa. The Climatic Range of Yellow Fever. Yellow Fever at Lisbon. In the West Indies and Brazil. Effects of "Moisture" on Temperature. Depressing Effects of "Damp Heat." Dry Air and Extreme Temperatures. Remarkable Instances of Great Heat. Dry Air and Cool Nights. Coincidence of the Mahometan Faith with Dry, Hot Climates. People of Colour. The Arabs. Influences of Climate on the History of Man. Droughts. The Phenomena of Dry Atmosphere. Therapeutic Effects of Dry Cold. "Equable Climates" necessarily "Moist Climates." The Winds. Created by the Sun's Heat. The Trade Winds. "The Doldrums." Land Winds. The Uses of Deserts. Monsoons. Indian Droughts and Famines. Equatorial Currents in the Celestial Altitudes. Rains. The Coming-up of a Sub-Tropical Rainstorm. Outburst of an Equatorial Thunder Storm. Value of Forests in Preventing Destructive Effects of Torrential Rains. Remarkable Instances of Great Rainfalls. Sudden Inundations Caused by Torrential Rains. The Coming down of the Great River Atbara. Danger of Encamping in Dry River Beds. Great American Rainstorms. The Coming down of an American Prairie Flood. Destruction of U.S. Army Camps by Sudden Floods. Supposed Causes of These Floods. Waterspout in Paris. Instances of Great Thunder Storms. Traveller Killed by Lightning. Thirteen Oxen Struck Dead in a Heap. The Bursting of the Indian Monsoon. Ideas of the Ancients on the Sources of Rain. The Superior Waters Above the Firmament. The Teachings of Modern Science upon Rain. The Vapour-Carrying Power of the Winds. Probable Cause of Blue Colour of the Sky. Evaporation in Visible Form. Great Atmospheric Disturbances. Tracks of Hurricanes Generally Follow Areas of Extreme Temperatures. Revolving Storms. The "Lull" of the Storm. Rules for Avoiding Cyclones at Sea. Force and

Velocity of the Wind in Great Hurricanes. Indications of an Approaching Cyclone. The Great West-Indian Hurricane of October 1780. Loss of a British Fleet. The Great Cyclone of 1703 in England. Cyclone on the Brahmaputra in 1876, and Loss of 100,000 Lives. Great Cyclone at the Mauritius in 1892. American Blizzards, or Storms Attended by Intense Cold. Partial Destruction of U.S. Waggon Train in a Blizzard. Buffalo Hunters Frozen to Death. Terrible Nature of Frostbite. Cause of Blizzards. The Great Blizzards of March 1888. The New York Blizzard and the English Papers. An English Blizzard. Possible Effects of a Great Storm in London. Dust Storms. Cause of Moving Pillars of Sand in the Desert. How they are Formed. Collapse of Dust Columns. The Army of Cambyses Alleged to Have Been thus Buried. Great Sand Storms in the Colorado Desert, and in Algeria. The "Ascending" Form of Tornadoes. The Horizontal Form. Tracks of Tornadoes through Forests. An English Whirlwind. The Great Atmospheric Ocean. The Barometer. Cyclonic Depressions. The Great Billows of the Atmospheric Ocean. Heavy Falls of the Barometer. What They Indicate. Why *Threatened* Storms Sometimes do not Occur.

NOWHERE do meteorological phenomena assume more immediate importance to the individual man than they do to the traveller in wild countries, whose life for the most part is passed in the open air, or at best under the shelter of a canvas tent. Hence it comes that the thoughtful traveller by land and sea has his attention continually drawn to the consideration of some one or other of those phenomena of Nature to which we desire to call attention in this chapter.

The influence of climate is felt, as we know, all over the world. But experience shows that people comfortably housed, and surrounded by all the refinements of an ultra-civilization, have rarely either time or inclination to bestow much thought upon the study of the weather: and so it has come to pass, amid the continual hurry and strain of the business of life, that the science of meteorology has been more or less neglected, even by men of science, until a comparatively very recent date. The systematic observation of the

weather for the purpose of foretelling the near approach of dangerous atmospheric disturbances, may, in fact, be said to have been initiated by the late Admiral Fitzroy, distinguished in his earlier days by valuable services in the survey of the coasts of South America, and subsequently as the Commander of H.M.S. Beagle, during her voyage round the world, undertaken for the purpose of scientific research in the third decade of the present century. He was accompanied throughout the last named expedition by Charles Darwin, who afterwards attained an imperishable renown in the world of science as a naturalist, etc., and it is in no wise straining the limits of probability, or of fact, to assume that both these cultivated men laid the foundations of future eminence in their respective spheres while engaged in the daily contemplation of the phenomena of Nature, during that eventful period (1831 to 1836); whether in examining the winds and tides, or the animal inhabitants of the mighty deep; or else in traversing (as Mr. Darwin did) the almost totally unknown wilderness of South America, together with islands, and other sections of wild country visited by the expedition.

Fitzroy especially, as the officer primarily responsible for the safety of its personnel, must have been throughout these years constantly employed in the consideration of such questions as we now propose to glance at. Upon the stormy and desolate coasts they were for the greater part of the time engaged in surveying. This subject of "The Wilderness and Its Tenants," must also perforce have been to both gentlemen their peculiar study, just in the same way as we propose to make it ours throughout these pages.

Before entering upon the question of the climatic zones, however, we think it desirable to open the subject with a survey of the leading features of climates, as these are exhibited to travellers proceeding from Europe to tropical and other distant lands.

We shall also endeavour to describe the extraordinary nature and intensity of some of the atmospheric disturbances by which these regions are visited, of which dwellers at home can form but a very faint and imperfect idea: for though the climate of Great Britain is variable and uncertain, it is in general free from the exceeding violence of the rains, hurricanes, and other storms, to which many foreign lands are subject. It is highly desirable that all travellers should possess at least a good general idea of these phenomena before visiting such countries, as there is great art in laying out an extended tour judiciously, so as to take the best advantage of the proper seasons for visiting the different climates included in the programme, and thus seeing them under the best and most agreeable conditions. In these days, when such numbers of persons make extended trips about the world, these matters assume a constantly growing importance—as there is a healthy, as well as an unhealthy season, in many of these countries. There can be no doubt that in former days many travellers fell victims to the effects of climate, either from visiting unhealthy places during the sickly season, or because they were unacquainted with the proper means of preserving health in such localities.

The extraordinary ignorance that prevailed in former times upon these subjects, even among otherwise highly educated men, can scarcely be conceived in these comparatively enlightened days, though we unquestion-

ably still have a very great deal to learn upon these important branches of science. It might, for example, reasonably have been supposed, that at all events expeditions fitted out under the auspices of the leading European governments would have been well advised in these matters; but in general it was the very reverse, and immense loss of life was incurred from the want of what now seem the most obvious precautions.

The records of British military and naval experiences in Africa, and in the East and West Indies, are full of warning and instruction in this respect. Sanitary science was, however, a thing that can hardly be said to have had any existence a few years ago.

Indeed, if an accurate return could be obtained of the thousands of lives that have been sacrificed to incompetence and ignorance of the elementary rules of this science, it would be one of the most appalling documents that has ever been published—and in defence of British officers it may be stated (if *that* can be of any satisfaction to us) that French records show that they did not do these things one whit better there. *

In the first place it was the general opinion in former days that strategic considerations often obliged troops to be quartered in low-lying, unhealthy positions, when a comparatively short march to the hills would, in many cases, have kept their men in good health and condition, ready at any moment to descend upon the plains, and act with the vigour and decision of which healthy men alone are capable.

It is true that under the stress of actual war this might not always have been practicable; but in these

* The French invasion of Madagascar in 1895 is a good modern instance in point.

days it seems hard to conceive that any considerations of this kind could have been held to justify the retention of Europeans, year after year, in time of peace, in pestilential quarters, when so obvious a means of preserving health existed; but it is unfortunately only through losses and sufferings that men are ever taught to reflect.

Instances of this kind might be multiplied almost without end, were it desirable to do so, which show that, in the words of Sir James Martin, a well-known Indian medical authority on these matters, it is not an exaggeration of the facts to say that, "with our commanders and statesmen, it has never been the disaster, or the loss of an army, but always the accusation of having caused it, that has disturbed their serenity."*

The fact is, in every country, however bad a reputation its climate may bear, there is always a healthy season, as well as a sickly one—and the great art for travellers and others is to know how to time their movements so as to avoid the latter, by selecting the proper moment for pushing rapidly through the unhealthy regions, to the comparatively healthy highlands beyond, before the bad season returns.

Generally speaking, there can be no doubt that for a traveller such an arrangement is perfectly feasible, provided, of course, that a man is his own master, and that the claims of business, or of duty, do not intervene to hamper his movements. The question is peculiarly one of arrangement and organization, every detail of which requires to be thought out beforehand, and it

* *The Influence of Tropical Climate in Producing Disease of Europeans*, by Sir James R. Martin, M.D., of the Indian Medical Council, 2nd Edit. 1861, p. 199.

is the capacity for exercising this discretion aright which constitutes the true "Art of Travel." That it is perfectly possible to secure these results under a proper system of management, even when directing the march of large bodies of men, under the stress of actual warfare, is conclusively proved by the results of several of our recent military expeditions.

British officers are now all of them highly trained, and often exceedingly scientific soldiers; and probably few people will be disposed to deny, without in the slightest degree depreciating the merits of our commanders in former days, that these recent triumphs are largely to be attributed to the judicious arrangements made for these expeditions, and the higher standard of education maintained among the officers of the present day over their predecessors of a generation or two ago. The older commanders acted according to their lights, and the state of knowledge of the times they lived in. The modern expeditions to which reference is made, are, 1st, the Abyssinian Campaign and march to Magdala, under the late Lord Napier, in 1867—8; 2ndly, the Red River expedition to Fort Garry, under Lord Wolseley, in 1870; and 3rdly the Ashanti War and expedition to Coomassie, under the same commander, in 1873.* In each of these cases, the difficulties to be surmounted proceeded from the climate, and the Wilderness. In both the African expeditions the climatic dangers were of course, heat, and malarial fever; while in that to Fort Garry it was the advent of the snows of winter and the general inclemency of

*Since these lines were written a second march to Coomassie has been performed in the early part of 1896, with equal success, under Maj.-Gen. Sir Francis Scott.

the weather; but in all three, a wise selection of the proper moment for starting, with adequate preparations made beforehand, for the supply of the necessary stores, combined subsequently with a vigorous prosecution of the objects of the expedition in sufficient force to ensure success—followed by an immediate withdrawal the instant this had been realized—enabled the commanders to bring them to a triumphant conclusion with comparatively trivial loss.

Those who witnessed the departure of the troops for Abyssinia and Ashanti will, however, doubtless remember the dismal foreboding with which the deadly nature of the climate was regarded. It is only necessary to refer to the files of the newspapers of the day to realize how strong a hold this view had taken upon the public mind.

Many people thought that very few of those who went out would ever return—nor can it be said that these fears were altogether groundless, for judging from the experiences of former expeditions at the end of the last and the beginning of the present century, very great losses seemed not improbable. But, by going at the right time, in the right manner, and lastly by getting away again in time, as we have pointed out, these disasters were avoided.

It will merely be necessary to refer to a single one of the many cases where in former times these things were done with an entire disregard to these considerations, to show the appalling consequences which ignorance and incompetence in such matters are almost certain to entail.

We shall select the case of the Walcheren Expedition of 1809.

The objective point, in this instance, was no pestilential African jungle, sweltering under the rays of a vertical sun; but some fortresses within a short sail of the English coasts, on the mouth of the Scheldt, upon the Dutch shores. This expedition was one of the most powerful and admirably disciplined forces that has ever sailed from the shores of this country,

"consisting of 35 ships of the line, with 200 smaller ships, and 40,000 men under the Earl of Chatham. The fleet, which was commanded by Sir Richard Strachan, with troopships under its protection, sailed from England July 28, 1809" *— "landed July 31st and August 1st, and by the 10th of October, 587 per 1000 men had fallen sick, and 142 per 1000 had died." †

The moment chosen for embarking this force was during the most unhealthy period of the year, to a place which, though situated in Europe, was of well-known malarious reputation, where a Scotch regiment in the Dutch service had been known to bury their whole number in three years, and where the French army lost annually one third of those employed, thus justifying the exclamation of Napoleon, on hearing that the English had occupied the island of Walcheren, "Only keep them in check, and the bad air and fevers will soon destroy their armies."§ And so in fact it did, for,

"from a Parliamentary return it appears that 7000 had been lost in the expedition, and that nearly half the troops engaged in it brought home with them the seeds of a distemper,

* Haydn's *Dictionary of Dates*.

† Sir James R. Martin, *The Influence of Tropical Climates in the Production of Disease*, 2nd Edition, 1861, p. 275.

§ *Ibid.*, p. 275.

which few were able entirely to shake off, during the remainder of their lives" *—and "the number of sick which were returned to England at various times, from Walcheren, amounted to 12,863." †

All this clearly shows that by neglect of sanitary precautions even a European climate may prove deadly.

Of course, in considering the question of "climate," it would be impracticable to discuss that of each particular country, or region, separately. The most that we can hope to do is to offer a few suggestions and remarks, which we trust may contribute to a right understanding of this important subject.

The best index to a climate will of course be the meteorological record of its weather, and the range of its temperature, extending over a series of years; because, as we know, in many places the climate varies greatly from year to year—and the further we go away from the Equator, the more considerable as a rule are these variations. It must also be remembered that climate depends upon a number of different considerations besides that of latitude—among the principal of which are elevation, and the quantity of moisture contained in the atmosphere. Temperature, which is such an all-important factor in the climate of a place, is mainly dependent upon these circumstances. We propose therefore to say a few words upon this question of "Elevation" in its relation to climate.

Now, the natural contour of the ground in every

* Alison's *History of Europe*, 2nd Edit. 1885, Vol. xiii, Chapter 60.

† Parliamentary Papers No. 24—Parliamentary Debates xv. 23. App. quoted from ibid.

country, and throughout every continent, is to a certain extent based upon similar lines—namely, that the land, rising from zero upon the coast line, gradually ascends, attaining to considerable altitude in the interior. Therefore the larger the area of a continent, the general presumption is the greater will be the elevation of its highlands.

Where this is not so, it must be obvious that except in waterless regions, the drainage would be so imperfect, that were the country perfectly flat, its interior would become a region of swamps and morasses; while depressions below the general level of the country would gradually fill with water, and form vast inland lakes or seas. We have good examples of this in the great lakes of North America and in the Caspian Sea in Asia, the level of which is fixed on the Russian ordinance map as 86 feet below that of the Black Sea. While in the waterless area of the Great Sahara of Northern Africa, it is stated on what is believed to be good authority, that one of these *dry* depressions actually does exist, needing only a canal from the Mediterranean to convert it into an inland sea, in the heart of a burning waste of sand and stones.*

The immense variations of climate due to elevation are well known. It has been variously estimated in what ratio temperature is affected by altitude. Baron Humboldt fixes it as amounting to a fall of 1 degree Fahr. in temperature for every 344 feet of elevation. Within the tropics, subsequent researches have, however,

* "According to Monsieur Roudaire, the author of the scheme for flooding the Sahara, it is possible to create an inland sea, with an average depth of 78 feet and an area of 3100 square miles, or about fourteen times the size of the Lake of Geneva."—*Encyclop. Brit.*, 9th Edit., Vol. xxi. p. 151.

shown that it decreases in a considerably greater ratio as the altitude increases, and it may be taken as an ascertained fact that in the intertropical regions the limit of the line of perpetual snow lies at *about* 16,000 feet above the level of the sea. "In the Bolivian Andes," for instance, "the snow line is fixed at this point," * and observations taken in Mexico and other places, have given results almost identical.

Descending from this extreme elevation we have every gradation of climate, down to the normal temperature of the Equatorial zone, amounting to about 86° Fahr. as the mean *shade* temperature of the day, at sea-level, throughout the year—the most characteristic feature of this region being the wonderful uniformity of its temperature—"As a general rule the greatest heat of the day does not exceed 90° or 91° Fahr., while it seldom falls during the night below 74° Fahr." † but "the usual daily range of the thermometer is only a little more than 11° Fahr." §

The hottest places in the world, that is to say, those places where the mean temperature of the year stands highest, are mostly situated in these regions upon, or adjacent to, the margin of the sea. In saying so, we wish to guard against misconception: we refer therefore at present, let it be distinctly understood, to the *mean* temperature only—because those places where the most intense heats are prevalent, at certain seasons, are usually subject to extreme ranges of temperature, being intensely hot at one time, and bitterly cold at others.

* Stanford's *Compendium of Geography and Travel for Central and South America*, 1878, edited by H. W. Bates, p. 207.

† *Tropical Nature*, by Alfred R. Wallace, 1878, p. 3.

§ *Ibid.* p. 4.

This, however, is a matter to which we shall refer more at length hereafter.

The flat character which the land is known to assume upon the seaboard of many countries, accounts for the formation of extensive areas of swampy land in such localities. Now it may be accepted as a matter of ascertained fact, that wherever stagnant water is associated with a powerful sun, malarial diseases are always prevalent—and therefore as a rule we find the coast line of most tropical countries is unhealthy; and in many cases it may even be considered deadly to Europeans, at certain seasons.

But as we penetrate into the interior and ascend the highlands, the climate in general becomes comparatively healthy. We shall here confine our remarks to the case of tropical countries, as the climates of temperate regions call for no particular notice in this respect: notwithstanding the great mortality, already referred to, in the Walcheren Expedition, where a number of circumstances point to the conclusion that the malarial affections were more or less complicated by those of a typhoid character, probably due, not to solely climatic influences, but to a contamination of the water supply.

The land upon the seaboard, as we have pointed out, often rises very gradually from the coast, and therefore in tropical regions a wide belt of unhealthy country, generally clothed with dense forests, has to be traversed before the highlands can be reached. The coasts of the African continent, especially those of the west coast, largely partake of this character. This has constituted one of the difficulties of African travel, which has contributed probably more than anything else to establish

an exaggerated notion of its unhealthy character. But as means of communication improve, affording facilities for pushing rapidly in to the elevated table-lands of the interior, we venture to predict that we shall hear less of the supposed peculiarly deadly nature of the African climate.

In other more favoured regions of the tropical world, the mountain ranges of the interior throw out spurs towards the coast, so that sometimes a very short journey brings the traveller to high and healthy stations, where in the midst of a delicious climate, closely resembling that of a perennial spring, he can look down upon the fertile lowlands, clothed in all the magnificence of tropical vegetation, and reside in safety, as long as he pleases, above the reach of their baneful vapours. Some of those charming spots may be set down (so far as climate is concerned) as the nearest approach that can be found upon earth to a terrestrial Paradise where flowers perpetually bloom.

The tropical regions of Central and South America have been specially favoured by Nature in this respect, and nowhere is this more the case than in the Republic of Mexico, which is at once one of the richest and most beautiful countries in the world. The effects of elevation in modifying climate are there exhibited under such striking conditions that we could not do better than give a short sketch of the climate of Mexico, as a good illustration of tropical nature in general.

Mexico is divided by the natives into three zones—the "Tierra Caliente" (or hot zone), the "Tierra Templada" (temperate), and "Fria" (cold). The Tierra Caliente comprises all the low-lying, hot, damp regions on the seaboard, upon the east

and west coasts as well as in Yucatan and elsewhere. It extends to 3000 feet above sea-level, and almost all the choicest treasures of tropical vegetation flourish there in the greatest luxuriance.

"Of 114 species of trees and cabinet woods, 17 oil-bearing plants, and over 60 medicinal plants and dyewoods, indigenous to Mexico, and often differing specifically from kindred varieties in Central and South America, by far the greater part are represented in the 'Tierra Caliente'." *

The wonderful beauty and luxuriance of some of the Mexican forest scenes can hardly fail to strike even the most superficial observer; and in the "Campo" or more open country, it is quite common to find small farmers raising on their own ground, and in the immediate vicinity of their houses, almost *everything* a man can want for food or raiment: sugar, coffee, cotton, bamboos, etc., etc.

"The mean annual temperature is from 77° to 82° Fahr., the extremes ranging from 59° to 104° F. The dry season (Estacion Seca) usually lasts from October till the middle of May; and the rainy season (Estacion de las aguas) from the middle of May till the end of September; but the greater or less regularity of the rainy season depends exclusively on the position and mean elevation of each locality. The showers generally last till midnight, leaving the early morning clear and bright. Besides the constant summer rainfall, there are also occasional storms and showers from December to February, called the 'Aguas Nieves' (snow rains). The rains as a rule begin first on the Atlantic seaboard, gradually spreading westward in the time of the trade winds." †

Unfortunately this region is unhealthy to Europeans,

* *Encyclop. Brit.*, 9th Edit., Vol. xvi. p. 217 (Article "Mexico").

† Stanford's *Compendium of Geography and Travel for Central and South America.* Edited by H. W. Bates, 1878, pp. 73 to 78.

malarial fevers of severe type being common; yellow fever and black vomit being also here endemic. "Vomito" as it is called, generally begins about April, when the hot weather sets in, and lasts till October.

Vera Cruz,* the usual port for entering the Republic, from the eastward, "is one of the most unhealthy places on the globe." † When the author last visited it, the jungle came up to within a short distance of the outskirts of the town, and numbers of turkey buzzards lived among the houses and walked in flocks about the streets.

But fortunately—in illustration of what we have already said as to the possibility of being sometimes able to pass rapidly through an unhealthy district on the coast, to a high and healthy station inland—even before the days of railways, all that the prudent traveller needed to do in this case in order to avoid the sickly season, was to proceed some twelve hours up the country to Jalapa, a distance of about 52 miles by the old trail, leading mostly through the forest and jungle. Since 1870, however, a railway, making a detour up to about 70 miles, makes the matter more easy still—and at Jalapa, which lies within the Tierra Templada, some 4500 feet above the sea-level, a delicious climate, combined with magnificent scenery, can be enjoyed, very little warmer than an ordinary English summer day, above the reach of the dreaded "Yellow Jack." It is true that people have died of yellow fever at Jalapa, as they have sometimes done at the quarantine stations in England, but they were persons who came up there from the Tierra Caliente,

* Vera Cruz., Lat. 19° 11′ 54″ N., Long. 96° 8′ 0″ W.
† Stanford's *Compendium*, p. 78.

with the infection upon them, and the disease did not spread to the residents of Jalapa. As Sir James Martin has pointed out—"It would seem that the diseases of tropical climates, like certain vegetable productions, are restricted to certain altitudes and particular degrees of temperature." *

There can be no doubt that this is so, though the confidence of the public in this assertion is from time to time shaken by the occurrence of these cases, brought up to the hills by persons in whose systems the disease is already latent. But to give, if possible, still greater emphasis to Sir James Martin's maxim, we may here mention the very remarkable fact that the range of altitude to which yellow fever ascends in Mexico and other places, is found to be coincident with that of certain plants. In the present instance it has been ascertained that as a rule, "this disease ceases at that altitude at which the Mexican oak (*Quercus Xalapensis*) commences to appear, that is at 2750 feet." †

Now, it is well known that temperature is the condition which, more than anything else, governs the range of plant life—and though the matter is by no means as yet very well understood, many of these diseases of malarial origin are supposed to be dependent upon germs of a parasitic origin, and, according to competent authority, yellow fever "is dependent for its origin and spread, upon a temperature not lower than 70° Fahr." §

At lower temperatures therefore, it is probable that

* *The Influence of Tropical Climate in Producing Disease*, by Sir James Martin, 2nd edit., 1861, p. 283.

† Stanford's *Compendium of Geography and Travel for Central and South America.* Edited by H. W. Bates, 1878, p. 73.

§ Quain's *Dictionary of Medicine*, p. 1798; Article "Yellow Fever."

these germs become inactive; and this view receives considerable support from the well-known fact that the mortality due to this disease always largely diminishes upon the occurrence of sudden and well-marked atmospheric disturbances—such as heavy rains, storms, or a fall in the temperature. But wherever there are populous sea-ports or other towns in low-lying situations—as long as the summer temperature keeps up sufficiently high (even though it be for a single season of exceptional heat)—we may on the other hand pretty safely assert that the place is never secure from the possible inroads of this terrible pestilence.

We may quote, for instance, the case (amongst others) of the fearful outbreak of epidemic yellow fever at Lisbon, at the close of a very hot summer, in October and November 1859, which attacked nearly 19,000 people, and carried off some 6,000 of the population living in and around the city, many of them being persons of the upper classes. On the whole, this is the most disastrous epidemic of this fell disease which has visited Europe during the century.

We have dwelt somewhat at length upon this subject, because yellow fever forms a constant bugbear to all European travellers and residents, throughout tropical America, while the range of this malady seems to be peculiarly one dependent upon such questions of elevation and temperature as we have just been considering. And the rule that holds good in Mexico seems generally to maintain itself under similar conditions elsewhere, notwithstanding that some exceptions are alleged to have occurred, owing to special circumstances, in Peru and elsewhere in South America. All that we shall venture to say on this head is that

in the absence of considerably stronger evidence we should hesitate to receive them as conclusive, for a number of reasons, which it would be too long to go into at present—especially as it is notorious that false alarms have from time to time been raised about supposed outbreaks of yellow fewer, which have afterwards turned out to be typhus, or some other form of outward febrile affections.

In the West Indies we may point to the hill stations of Jamaica and San Domingo, which have thus far proved to be exempt from this scourge. Another instance is met with in Brazil, near Rio Janeiro, itself a hot and unhealthy place at certain seasons, with defective sanitary arrangements, from which a short journey, in like manner, takes the traveller through lovely scenery to Petropolis, which at an elevation of some 2400 feet above sea-level, has thus far also proved exempt from epidemics of this disease. Similar cases might be multiplied—but we pass on to the consideration of another important factor in climate, namely, the effect of moisture in the form of atmospheric vapour. According to the Encyclopædia Britannica, "Climate is practically determined by the temperature and moisture of the air, and those in their turn are dependent on the prevailing winds, which are charged with the temperature and moisture of the regions they have traversed." *

But these conditions are constantly modified, as we have already pointed out, by the elevation of the land above sea-level. It is, however, only when we come to contrast the effects of a dry with those of a humid

* *Encycl. Brit.* 9th edit. Vol. xvi, 1883, p. 114.

atmosphere that we realize the enormous influence which moisture has in modifying climate by checking the radiation of heat. In hot, damp climates, such as that of the Equatorial Zone for instance, it is the means whereby the night temperature is kept up to nearly the same point as that of the day. Thus, at Batavia, "the usual daily range of the thermometer averages only a little more than 11^0 Fahr.: being 12^0 6′ in September, when it is greatest, and only 8^0 1′ in January, when it is least" *—the heat of the day being at the same time so moderated by the atmosphere, that it is rarely very hot; the very high temperatures met with in dry regions being here totally unknown.

During the fifteen years, 1866 to 1879, both inclusive, "the greatest maximum temperature (in November 1877) was 96^0 8′ Fahr., and the lowest minimum 66^0 69′ F. (in September 1877) and the *mean* temperature for the same period was 78^0 69′ F. It is this long unbroken continuity of high temperatures which proves trying to the European constitution, for the new-comer seldom feels himself much oppressed by the heat." †

The great reason why hot damp climates are so trying to Europeans, is because of the great heat of the night, the atmosphere being always precisely like that of a plant stove or orchid house at home. In fact the object of these structures is, as we know, to create an artificial atmosphere similar in all respects to that of the native habitat of the plants intended to be grown therein; and in some of the most trying of these climates the natural condition of the atmosphere is

* *Tropical Nature*, by Alfred R. Wallace, 1878, p. 4.
† *Encyclop. Brit.* 9th edit. Vol. xiii. p. 601; Article "Java."

often as still and hot as that found inside one of these houses. The great heat of the night, therefore, prevents many people who feel the heat greatly, from obtaining sound and refreshing sleep. The minimum temperature of the 24 hours, it must be remembered, merely as a rule represents that of the last hour or two before sunrise, and by no means that of the greater part of the night, during which it stands considerably higher. Sound sleep is therefore in many cases only enjoyed during the morning hours:—this serious matter is a frequent cause of trouble in these climates.

On the other hand, the intense solar temperatures which we hear of as being registered occasionally, do not as a rule occur in the intertropical regions at all. Where high temperatures, such as those exceeding 100° F. in the shade, do occur in the tropics, they usually do so in dry districts, such as the deserts of the Soudan, during the prevalence of hot winds, and under circumstances when the atmosphere ceases to exert that power with which it is endowed, in moister regions, of tempering the excessive heats, in consequence of the absence of aqueous vapour; or the temperature may be affected by the refraction of heat from sand, rocks, and other exceptional causes: and thus, phenomenally high temperatures may be produced.

The highest solar temperatures generally occur in the zones of dry country which extend in belts around the earth wherever there is land, somewhat to the northward of the Tropic of Cancer, and to the southward of the Tropic of the Capricorn. These therefore may be regarded as the zones of maximum solar temperatures. Or possibly, it may be, still further to the north and south, extreme heats may occur, on

occasional days, even in places situated in the temperate zones. These cases are, however, of course entirely exceptional.

Some of these extreme temperatures which have occasionally been registered, are so extraordinary, that it may be desirable to quote a few instances of what great heat can occasionally be like. South Australia and Victoria, for instance are

"subject to hot winds from the interior resembling the blast from a furnace, and the thermometer rises to 115° Fahr. and occasionally even higher." * "In the desert interior these hot winds are still more severe. On one occasion Captain Sturt hung a thermometer on a tree shaded from the sun and wind, and it was graduated to 127° Fahr., yet the mercury rose till it burst the tube. The heat therefore must have been at least 128° Fahr., which if long continued, would certainly destroy life. For three months Capt. Sturt found the mean temperature to exceed 101° Fahr. in the shade. Every screw came out of their boxes, the horn handles of instruments and combs split up into fine laminæ, the lead dropped out of their pencils, the wool of sheep ceased to grow, and their finger nails became brittle as glass." † In Sindh also—"We have a climate of intense heat from March to November; during the six hottest months in the year the mean temperature in the shade is given as 98° 5′ Fahr., but in Upper Sindh the thermometer sometimes registers 130° Fahr. in the shade." §

* During one of these hot winds, within our own experience, in Australia, all china and glass in closed and shaded rooms felt hot to the hand, as if it had been lately placed near a fire—all water in jugs was quite hot—all bedclothes, clothing, etc., felt as if they had been recently warmed before a fire. Everything in fact assumed a certain temperature approximate to that of the atmosphere.

† Stanford's *Compendium of Geography and Travel for Australia.* Edited by Alfred R. Wallace, 1883, p. 17 and following pages.

§ Murray's *Handbook for the Bombay Residency*, 1881, p. 2.

All over the plains of Northern India, as is well known, periods of intense heat are common, indeed according to the Encyclopædia Britannica, "The heat of the great plain of Northern India is not surpassed by any other part of the earth, rising in the hottest months to more than 110° Fahr." * The meaning of this we take to be that the intense solar temperatures are here kept up longer than elsewhere.

Speaking on the same subject, Captain Rice, the well-known Indian sporting authority, remarks respecting the intense heats experienced during the hot season in India that—

"It is almost impossible for those who have never experienced it to conceive how terribly hot the rocks and stony ground exposed to the sun become. So much so, that the hand cannot be kept on one particular spot for even five seconds, without one feeling glad enough to remove it. So the guns, if placed on the ground for even a few minutes, become so dreadfully hot that it is distinctly painful to handle the metal. If obliged to lie, or sit down, on hot rocks, it is absolutely necessary to have some protection first spread over the burning ground." †

Then as regards cases of occasional extreme temperatures occurring in the temperate zone, we may content ourselves with a single instance reported at Omaha in the United States. The City of Omaha, it seems,

"had the thermometer at 120° F., in the coolest places to be found, for several days, during the summer of 1874: while the winter temperature of the same years sent the

* *Enclyp. Brit.*, 9th Edit., Vol. xi, p. 829.

† *Tiger Shooting in India*, by William Rice, Lieut. 25th Bombay N.I. 1887.

mercury down to −28° F., a yearly variation of 149°." *

Then, as we have stated in the Soudan and other parts of Northern Africa, in the great Sahara, etc., very extreme temperatures are occasionally recorded, due in a great measure, there can be no doubt, to refraction of heat from the bare and stony surface: but above all, we cannot too often insist upon it, to the dry condition of the atmosphere. Solimos in his "Desert Life" informs us that the "sand temperature one day marked 146° Fahr.—temperatures of 170° Fahr. were also found near Jaffa; and Duveyrier found the Sahara one day over 182° Fahr. †" But these would propably be sun temperatures. On other occasions he tells us

"Matches were lit by touching the sand with them" § —"Blankets drawn one over another or even slightly shifted, blazed up like sheet lightning" **—"The heat was 109° Fahr. among clothes in a trunk, and 111° Fahr. in the wind: combs, vulcanite, bone or horn, became brittle and useless." ††

Sir Samuel Baker fully confirms many of these facts; he also found woollen clothes and blankets gave off a sheet of flame when suddenly drawn apart, accompanied by moderately loud reports, and he tells us that in the desert between Korosko and Abu Hamed in Upper Egypt the thermometer registered

"114° Fahr. in the shade and 137° F. in the sun, in May, during the hot season. All woodwork is warped, ivory knife

* *The Hunting Grounds of the Great West*, by Lieut.-Col. Dodge, U.S.A., 1877, p. 42.
† *Desert Life*, by B. Solimos, 1880, p. 38.
§ *Ibid.* p. 16. ** *Ibid.* p. 27. †† *Ibid.*

handles split, and paper breaks when crushed up in the hand." *

On his return from the Nile sources Sir Samuel Baker found the thermometer, at Suakin, marked 115° Fahr.

We might largely increase the number of instances where these intense heats are recorded, by quotations from the works of various authors, did not time and space forbid. What we desire, however, more particularly to point out, is that where these great heats do occur, they are certain—when they are not accompanied by hot winds—to be compensated for by the occurrence of cool nights: because the same cause which operates to produce these extreme temperatures by day, namely, the want of aqueous vapour in the atmosphere, is sure to create an exceedingly rapid radiation of heat the moment the shadow of the earth intervenes to shield us from the fierce rays of the sun—and although the ground may have been heated ever so much during the day, the temperature falls so rapidly by night, that towards morning the traveller is often glad of all the extra coverings he can obtain.

The German traveller Dr. Barth, for instance, after describing the great heat of the desert in Southern Tripoli, mentions that the guide of the Arab caravan—"begged me to beware of the cold during the night, which he represented as very intense," † and it is a fact well known to all travellers that though the heat in the Sahara is often very extreme by day, yet the nights are uniformly cold, when the hot wind does not

* *The Nile Tributaries of Abyssinia*, by Sir Samuel Baker, 1887, p. 17.

† *Travels in Africa* (1849 to 1855), by Dr. Barth, Vol. i, p. 185. (Undertaken under the directions of H.B.M. Government, and published 1857—8).

blow, and though it may seem absurd to the ears of the general reader, a good warm ulster is a very necessary part of a traveller's outfit for nightwork in these regions. In the Empire of Morocco the Bedouins all have a sort of long, thick, brown-striped woollen garment, made of native cloth and furnished with a hood, called a "haik," for this purpose, which can with a little trouble be easily adapted for the use of Europeans. Before the days of ulsters, the author found this haik a good and efficient substitute for that now almost indispensable garment, which has contributed so largely to the comfort and health of modern travellers.

Of course it goes without saying, that for a traveller to be without ample protection against the sudden falls of temperature at night, and especially against the bitter chill of the small hours of the morning, is one of the surest ways of laying the seeds of fever, rheumatism, or some other serious ailment—a matter which we shall have a good deal to say upon hereafter, in the proper place. But barring accidents from this preventable cause, the beneficial effects of these cool nights in bracing up the constitution against the exhausting heat of the day, is very marked.

Hence it comes that these very high temperatures are not found to produce the same evil effects as the considerably lower ones met with in damp, steamy, tropical climates. The dry zone of desert countries which extends across the continents of Asia and Africa, is therefore comparatively healthy—notwithstanding that they comprise within their limits what are probably the hottest countries in the world—that is to say, those countries where the range of the thermometer

is by far the greatest and the solar temperatures highest.

It is a remarkable fact that almost the whole of this immense region is co-terminous with the limits of the strongholds of the Mahometan faith, showing that even opinions, like plants and animals, have their special climatic range. * Now, these people, mostly of the Arabic race, as we know, comprise what are physically speaking some of the finest and most war-like races of mankind: showing that the fierce rays of an incandescent sun have not impaired their native vigour; and though it has, in various degrees, bronzed their complexions, till sometimes—possibly by an admixture of Negro blood—they are as black as any native of Africa: this has, however, not detracted from their manly beauty, for nowhere are finely chiselled classical faces more common.

This is a fact which has been noted in all ages, notwithstanding the European prejudice against people of colour. Thus, the picturesque Moorish prince, attired in all the magnificence of oriental costume, while apologizing for his sun-burnt face, in Shakespeare's celebrated play, is supposed to address his English sweetheart in the following strain:

"Mislike me not for my complexion
The shadowed livery of the burnish'd sun
To whom I am a neighbour, and near bred." †

In like manner, so far back as the ancient scriptural times, we find the dark-visaged oriental defending

* See some interesting observations, with maps, in illustration of this point, pp. 43—4 in "*Seas and Skies in Many Latitudes*," by the Hon. Ralph Abercromby, 1888.

† Shakespeare's *Merchant of Venice*, Act 2, Sc. I.

against the disparagement of the Jewish maidens, those swarthy lineaments on which the sun had set its seal, and exclaiming:

"I am black but comely, O ye daughters of Jerusalem, as the tents of Kedar, as the curtains of Solomon. Look not upon me, because I am black, because the sun hath looked upon me." *

In all ages the east has been the region of romance, and to this day the figurative language of the Arabs gives expression to their ideas in the exact style of the Old Testament. † There can be no doubt that both this oriental cast of thought, and the primitive habits of these nomadic tribes are entirely due to the peculiar climatic influences which we have been discussing; for as Sir Samuel Baker has clearly pointed out—

"The Arabs are creatures of necessity, their nomadic life is compulsory, as the existence of their flocks and herds depends upon the pasturage. Thus with the seasons they must change their localities—precisely as the wild beasts of the country are driven from place to place, either by the arrival of the fly (the seroot), the lack of pasturage, or by the want of water; even so must the flocks of the Arab obey the law of necessity in a country where the burning sun and total absence of rain, for nine months of the year, convert the green pastures into a sandy desert. In the absence of a fixed home, without even a village that is permanent, there can be no change of custom. His wants must be few, as the constant changes of encampment necessitate the transport of all his household goods." §

It is in fact, as Lord Wolseley has expressed it, in

* *The Song of Solomon*, Ch. i. Verses 5 and 6.
† Sir Samuel Baker, *The Nile Tributaries of Abyssinia*, 1867, p. 129.
§ *Ibid.*, pp. 128—9.

a recent speech upon "The Study of War," made before a military society lately established in Ireland—"the physical features of the world that have most influenced the history of man" *—and though this axiom may be accepted as applicable to every part of the earth's surface, of course it is peculiarly so in these dry regions to which these observations refer—for during the long rainless season the greater part of this country becomes, in the strictest sense of the word, an utterly barren desert, where neither man nor beast can find subsistence, as the extreme heat of the sun, the utter drought, and the scorching breath of the simoon, causes all vegetation to shrivel up and apparently entirely to perish; so that ultimately the dried grass breaks in the wind, and is carried away in dust, leaving the earth utterly naked and bare. The desert is then the desert indeed: yet on the return of the "kharif" or rainy season, as the same authority observes—"the whole of this country is covered with excellent pasturage, and far from resembling a desert becomes a mass of bright green herbage." †

The most striking feature of these sun-stricken regions, as we have already observed, is the refreshing coolness and beauty of the nights; which have been made the subject of remark by all travellers who have visited these parts of the world. We cannot do better than again refer to the pages of Sir Samuel Baker, in illustration of it—

"I much prefer," he says, "the intense heat of summer to the damp of the rainy season, which breeds all kinds of

* Speech of General (now Field Marshal and Commander-in-Chief) Lord Wolseley in Dublin, reported in Article of U.S. Magazine for March 1891.

† Sir Samuel Baker, *The Nile Tributaries of Abyssinia*, 1867, p. 61.

vermin. During the hot season the nights are cool and delightful. There is not one drop of dew, and we live entirely in the open air, beneath the shade of a tree in the day, and under a roof of glittering stars at night. The guns never rust, though lying on the ground, and we are as independent as the antelopes of the desert; any bush affording a home within its limits of shelter" *—

and again, speaking of the night in the Soudan desert, he states—

"There was an indescribable delight in the cool night, when, in the perfect certainty of fine weather, we could rest in the open air, with the clear bright starlit sky above us. There were no mosquitoes; neither were there any of the insect plagues of the tropics: the air was too dry for the gnat tribe; and the moment of sunset was the signal for perfect enjoyment."†

These paragraphs describe in the clearest manner the peculiar charm of night in these hot dry countries, which afford, as we have already pointed out, a period of cool and refreshing rest to both mind and body, exhausted by the overpowering heat of the day—and we might amplify these facts, were that desirable, to any extent, by quotations from the works of other travellers. It is true that hot nights do sometimes occur, but that is always, as we have explained, during the prevalence of hot winds.

These remarks upon dry atmosphere would, however, be incomplete without some observations respecting its action at high altitudes.

In South America, and also in Thibet, table lands of immense extent are met with, lying at elevations

* Sir Samuel Baker, *The Nile Tributaries of Abyssinia*, 1867, p. 185.
† *Ibid.*, p. 36.

of 10,000 to 15,000 feet and upwards over sea-level.*

Here, all the peculiar effects of a dry atmosphere, such as we have already described, are again exhibited, but in an exaggerated degree. Those who have visited these regions, have always been struck with the intensity of the sun's power, so long as one remains exposed to its rays; but on the other hand, the peculiarly searching nature of the cold the moment one enters the shade, is no less remarkable—while at night, as might be expected, its intensity is something extraordinary. These phenomena may be witnessed to a certain extent in Europe, by those who make a winter visit to St. Moritz, and other places in the Upper Engadine, which lie at an elevation of some 6100 feet above sea-level.† During the brilliant sunshine of a cloudless day the heat on these occasions is often so considerable that visitors skating on the lakes are obliged to be dressed in the thinnest summer clothing—but the moment the sun goes down, or that night approaches, the cold is that of the arctic regions. These variations of temperature in a dry atmosphere, however, are not so objectionable as they would otherwise be; for Dr. Tucker Wise, the English physician at Maloja, states that—

"it is by no means rare for individuals to quit a room and proceed out of doors, with a difference of 50° and occasionally of 60° Fahr., without feeling any very pressing need of gloves or extra clothing"—and provided there is no wind—"on the bright days of mid-winter, surrounded by ice and snow, the new visitor marvels that the low temperature is unperceived, and that the sun's rays carry with them the heat of summer."—"Ordinary catarrh," he also tells us,

* Murray's *Handbook for Switzerland*, 1886. † *Ibid.*

"is at this season almost unknown, except in the badly ventilated houses." *

On the great table lands of the Andes, in Peru and Bolivia, beneath the rays of a tropical sun, these extreme variations of temperature are, as might be expected, even still more extraordinary.

"In May and June (their winter months) at midday in the shade there is an average temperature of 55° Fahr., and during the rest of the year of 64° Fahr., but in the sun of 110° and upwards. This great disparity between the temperature in the shade and in the sun, is everywhere met with on elevated table lands, at a height of more than 10,000 feet: and is explained by the rarefication and dryness of the atmosphere, which unlike damp air, is unable to retain and diffuse solar heat, whether on its passage from the sun or reflected from the ground." †

Speaking on this same subject, Dr. Tucker Wise observes that—

"It is remarkable what misunderstanding prevails on the subject of humidity in relation to equability of climate. Books are written, extolling certain places as being 'dry and equable.' It is not too much to say that there is no climate on the face of the earth which is 'dry and equable.' Nearly every climate which has a small range of temperature is necessarily a moist one, for it is the alternate evaporation and condensation of moisture which limits the range of the thermometer." §

We must next consider the influence of the winds as a factor in the determination of climate.

Some writers have even (and as we believe rightly)

* *Alpine Winter in Its Medical Aspects*, by A. Tucker Wise, M.D., Third Edition; p. 98 (Pamphlet, no date).

† Stanford's *Compendium of Geography and Travel for Australia and South America*, edited by H. W. Bates, 1878, p. 207.

§ *Alpine Winter in Its Medical Aspects*, p. 41.

considered wind entitled to a leading place in this respect, because rains and other changes of weather are mostly brought about by variations of wind, producing sudden alterations of temperature.

Thus rain, as we know, is caused by a warm current of air, surcharged with watery vapour, meeting a cold one, which condenses and precipitates its superabundant moisture as rain.

In a changeable climate like England, therefore, the influence of the winds is peculiarly marked, and those who aspire to become weatherwise there will find noting the variations of the wind, by means of a vane placed in some commanding position, one of the best aids in making forecasts as to weather. The cause of our rainy climate, for instance, becomes apparent when we observe that the prevailing wind is from the S.W., and that this wind comes to us across a vast expanse of ocean, from warmer latitudes, and therefore surcharged with vapour, which is precipitated on meeting with our variable and colder winds.

We have, however, placed heat (*i.e.* temperature) and elevation, which, as we have explained, modifies temperature in certain well-known mathematical ratios, before wind, as the two leading factors of climate, because it is now pretty well a matter of ascertained fact that wind is simply a product of heat, and that the sun—which is the ultimate source of every form of life and movement, and in the widest and most literal sense of the term, governs everything here on earth, —among other things, creates the wind.

"From the heat of the sun," says Professor Tyndall,*

* *Heat a Mode of Motion*, by Professor John Tyndall, F.R.S., 1875, p. 164.

"all our winds are derived." These matters are, however, very fully discussed in meteorological works, and we shall therefore merely venture, in these pages, to offer a few remarks upon some of the more specially remarkable effects which the winds exercise upon climate.

There can be little question that the "Trade Winds" stand first in this respect; and that these winds which, from the parallels of about 30 or 35 north and south of the equator, are unceasingly sweeping round the equatorial regions at a speed of some 10 or 12 miles an hour, exercise a most powerful influence upon climate, everywhere throughout the world, as the chief rain-producing winds. Observations show that from the belt of calms, or light airs, which prevail in the neighbourhood of the equator we have two zones of originally dry hot, and therefore evaporating winds, whose average temperature is from 78° to 80° Fahr., extending entirely round the earth—*viz.*, the Zone of the N.E. trade, to the northward of the equator; and that of the S.E. trade, to the southward of it;—and that,

"with slight interruptions these winds blow perpetually, and are as steady, and as constant, as the currents of the Mississippi River; always moving in the same direction, except where they are turned aside by a desert, or a rainy region, here and there, to blow as monsoons, or as land and sea breezes." *

Another fact worthy of note is that though those winds are, as we have said, in all probability the chief

* *The Physical Geography of the Sea*, by Lieut. Maury, U.S.N., 1877, 17th edit., p. 78.

rain-producing factors of the world, yet, "in the region of the trades the rainfall is everywhere small over the open sea," * 1st, "because their course is directed into regions that become constantly warmer" †—and 2ndly, because their steady nature leaves few opportunities for meeting with variable currents of colder air. Thus at Ascension, in Latitude 8° 45′ S., which is always within the course of the S.E. trades, the mean rainfall for 1854 and '55 was only 8.85 inches, and at St. Helena, also situated within the same, the observations of five years give a rainfall of only 5.36 inches on the coast. § But the moment the interior of that island is reached, observations taken at an altitude of 1763 feet above sea-level, according to the same authority, show that it has immediately increased to 23.98 inches, because of the fall in the temperature produced by this increased elevation. We have drawn particular attention to these facts, as showing how completely rainfall is governed by variations of temperature.

The influence of the trade winds upon navigation has, Lieut. Maury tells us, been laboriously investigated at the National Observatory at Washington, and results show that the average speed of vessels sailing through the south east trades of the Atlantic, which are both stronger and steadier than the N.E., was 6.1 knots an hour between the parallels 5 and 10 degrees South; and 5.7 knots between 25 and 30 degrees South. **

Experience shows that sailing ships, after entering

* *Encycl. Brit.*, 9th edit. Vol. xvi, p. 150.
† *Ibid.*, p. 150.
§ *Ibid.*, p. 150.
** Lieut. Maury, U.S.N., "*Sailing Directions*," 8th Edit. Vol. ii, p. 857.

the trades, can often stand on upon their course, making from 5 to 6 knots an hour, under ordinary circumstances, for many days together, without perhaps once having to call upon the watch to trim a sail. We have seen this done ourselves; and for those who can enjoy life at sea, this portion of the voyage is generally most agreeable. As a rule, it is a region of fine weather. The sun is, of course, very powerful by day, rendering good awnings a necessity for comfort, but the temperature of the nights, with their soft balmy breezes, beneath the usually almost cloudless canopy of a brilliantly starlit sky, is most delicious. And the experienced traveller, about to proceed upon an ocean voyage, will not forget when engaging his cabin, to see that its port opens towards the eastward, so as to obtain the full benefit of these refreshing breezes—that is to say, when outward bound from England it should be on the port side, and on the homeward voyage on the starboard side. We call attention to this, because the guide books for passengers proceeding to India *via* the Suez Canal and Red Sea, give opposite advice, because the winds are deflected there from local causes; our remarks here therefore are to be understood as applying to ocean voyages only.

It is obvious that near the equator the trade winds must meet. Here, therefore, we find a region of calms and rains prevails, known among sailors as "The Doldrums," which separate the two systems of trade winds. It is calm, because these winds, as it were, neutralize each other in meeting; it is a region of rains, because in doing so an upcast current of heated and moisture-laden atmosphere is created, whose aqueous

vapour condenses on reaching the higher and cooler regions of the great altitudes and so produces the equatorial rains. This belt of calms, however, like the trade winds themselves, varies somewhat, both in extent and position, according to the time of year—its most usual position, according to Lieut. Maury, is, however, from about Lat. 5^0 to 10^0 N., from whence it shifts at times nearly down to the equator. *

If, as we have stated, a voyage in a sailing ship is delightful while passing through the trade winds, it is unfortunately very different on reaching "The Doldrums," for there vessels are often detained for two or three weeks, idly rocking to and fro upon a sea looking like a sheet of glass—in an atmosphere as close as that of a stove house, with the thermometer standing at 88^0 or 90^0 Fahr. between decks—and in the days of the old sailing East Indiamen, when passengers were cooped up for months together on board troopships proceeding to the East *via* the Cape, the women and children, and other delicate persons, used to suffer severely. It was, as Lieut. Maury expresses it, when alluding to the early Australian emigrant ships, "a frightful graveyard on the way to that golden land," and probably nowhere is the enormous advantage of steam over sails more apparent than in crossing these calms on board a modern ocean steamer, which now frequently makes runs of nearly 400 miles in the 24 hours. The "Doldrums" seldom extend over more than about 5 or 6 degrees of latitude, that is some 300 or 360 nautical miles, a distance which is easily run by a first-class ocean liner in about 24

* *The Physical Geography of the Sea*, by Lieut. Maury, U.S.N., 16th Edit., 1877, p. 77.

hours—indeed, the whole period required for one of these vesels to run through the tropics from Lat. 23° 30′ N. to Lat. 23° 30′ S., does not exceed eight days. * These few facts probably place the revolution effected by steam over sails in a clearer light than any more detailed description could do.

Space, and the nature of our subject, will of course preclude any attempt at a description of winds in general; we therefore confine our remarks to the great systems of the trade winds prevailing upon the ocean, because of their extreme importance upon the subject of climate, and because their action may be witnessed at sea in a way which it cannot be on land.

A variety of causes combine to modify the course of the winds on land. Wherever the earth, for example, becomes highly heated by the sun's rays, the atmosphere near its surface becomes rarefied, and ascends, thus creating an indraught to supply its place. The question which often arises in enquiring minds—What is the use of deserts? may here perhaps receive some attempt at solution. Deserts have their uses in modifying the action of the winds, and it may be are created as one of Nature's great mediums of atmospheric circulation. There can be no doubt that by deserts, and other extensive dry plains, the natural action of the trade winds is disturbed, and what is known as a "Monsoon," or deflected trade wind, takes their place. It is, however, on great continents like Central Asia, Africa, and Australia, where these phenomena are best witnessed.

* New Zealand Shipping Company's *Handbook for Passengers*, 1889, p. 13.

The importance of the monsoons in India is too well known to need any detailed description. It is to them that the ebb and flow of the rainy seasons are due; and when these rains fail, droughts, with consequences which are fearful to contemplate, ensue. In fact it may be said that the history of the great famines of the east, where millions of unhappy persons have sometimes perished, is synonymous with "Drought." "All the great Indian famines of which we have record have been caused by drought repeated over a series of years" *—that of 1876 to 1878 being probably the most serious of those that India has suffered from during the period of British rule. It began by the failure of the monsoon of 1875. Her Majesty's Indian Government nobly exerted themselves on this occasion to minimize the distress as far as possible, and "the total expenditure of the government on this occasion may be estimated at £8,000,000 sterling, not including the loss of revenue" †—it has, however, "been estimated on substantial grounds that the mortality in the provinces subject to British rule during the famine and drought of 1877 and '78 amounted to five and a half millions" in excess of the usual average death rate, while the "number of births was lessened by two millions."—"The total reduction of the population would thus amount to about seven millions." § Coincident with this famine in India another fearful famine desolated North China—it was very severe in 1877 and '78 when owing to the mismanagement and apathy on the part of the Chinese government "*nine*

* *Encycl. Brit.* 9th edit., Vol. xii, p. 766.
† *Ibid.*, vol. xii, p. 767.
§ Report of the Indian Famine Commissioners.

and a half millions of people are said to have perished." *

We merely cite these facts as an illustration of the enormous importance which the natural sequence of rain-bearing winds in some cases assumes. The trade winds, as we have stated, on the high authority of the late Lieut. Maury, are the principal evaporating and rain-bearing mediums. We wish we could find space for a more complete survey of this, one of the most wonderful of all natural phenomena, but we must content ourselves with offering but a single quotation from Lieut. Maury's works, in support of what we have already stated upon this subject.

"The S.E. trades enter the Northern hemisphere, and as an upper current bear into it all their moisture."—"All the air which comes loaded with moisture from the other hemisphere, travels in the upper regions of the atmosphere, until it reaches the calms of Cancer: here it becomes the surface wind that prevails from southward and westward; as it goes north it grows cooler and condensation commences. We may liken it to the wet sponge, and the decrease of temperature to the hand that squeezes the sponge. Finally, reaching the cold latitudes, all the moisture that a dew point of zero, or even far below, can extract, is wrung from it," †

—and subsequently, we may add, this air returns towards the southward as dry atmosphere, and re-enters the trade wind regions to recommence its round of duty. Such, in brief, is the general outline of the atmospheric circulation of our world—varied and modified, according to local causes, in a thousand ways, we need hardly say—which it would be quite out of

* Haydn's *Dictionary of Dates*—Article "Famines."

† *The Physical Geography of the Sea*, by Lieut. Maury, U.S.N., 1877, pp. 118 and 119.

the question to go into here, even had we the technical data to enable us to do it.

We may, however, point out that substantially the same phenomena are witnessed, where there is land, in the southern hemisphere. We refer to the hot winds which constitute a remarkable feature in the meteorology of Australia, whose temperature on the inland plains often for days together reaches from 110° to 116° Fahr. *—These great currents of heated air "are evidently produced by the sinking down of the N.W. current of heated air which is always passing overhead."—"That there is a constant current overhead from N.W. to S.E., may be traced day after day, and month after month, by the small clouds which mark its lower limits passing in ceaseless streams to the S.E. The great interior plains, which are almost treeless and waterless, act in summer like a great oven; and thus become the chief motor force of Australian winds, by causing an uprush, and consequent inrush on all sides, especially on the N.W., where it has sufficient power to draw the S.E. trade wind over the equator, and convert it into a N.W. monsoon"—which "forms part of the great return current from the equator towards the South Pole." †

These remarks upon winds naturally lead us to the consideration of rains, a product of wind, and as those occurring at irregular intervals in the temperate zone present no feature of very special importance, we shall mainly confine our remarks to the far more remarkable phenomena attending the bursting of the monsoons and other periodical rains in countries which possess regular hot and dry seasons.

We have already alluded to the disastrous effects

* Stanford's *Compendium of Geography and Travel for Australia*, edited by A. R. Wallace, 1883, p. 29.

† *Ibid.*, p. 30.

which droughts produce over immense areas of the earth's surface; it would be easy to multiply instances of these calamities which have at times caused tremendous losses to settlers in South Africa, Australia, South America, and other places. The historical records of the Old Testament, for instance, teem with accounts of the sufferings inflicted upon the peoples of the East by droughts and famines, many of which are full of dramatic power and pathos. It would be difficult to find a better example than is afforded to us by one of these, where the bursting of the monsoonal rains, after a long continued drought of three and a half years, is graphically described in the sacred writings.

It was the occasion when the Prophet Elijah had gone forth to meet Ahab, the King of Israel, about the year 914 B.C.* At this time, as we are told, "there was a sore famine in Samaria"—so much so that Ahab had called Obadiah, the governor of his house, into his councils and, commanded him to—

"go into the land, unto all the fountains of water, and unto all brooks; peradventure we may find grass to save the horses and mules alive, that we lose not all the beasts. So they divided the land between them, to pass throughout it. Ahab went one way by himself, and Obadiah went another way by himself." †

Subsequently Elijah meets Ahab, and the scene is changed to Mount Carmel, a high promontory overlooking the Mediterranean, and rising to an elevation of about 1500 feet, § where all Israel was gathered

* Chronological Table, Murray's *Handbook for Syria and Palestine*, 1855, p. 12.

† *I. Kings*, xviii, verses 5 and 6.

§ Calmet's *Dictionary of the Bible*, 14th edit. 1861. Edited by the late Chas. Taylor—article "Carmel."

together, at the King's command, to meet Elijah, and witness the destruction of the Prophets of Baal. In the closing verses of the same chapter the coming of the rains is described as follows—

(41) "And Elijah said unto Ahab, get thee up: eat and drink; for there is a sound of abundance of rain. (42) So Ahab went up to eat and to drink: And Elijah went up to the top of Carmel, and cast himself down upon the Earth, and put his face between his knees. (43) And said to his servant, Go up now, look towards the sea. And he went up, and looked, and said, There is nothing.—And he said, Go again seven times. (44) And it came to pass at the seventh time, that he said—Behold there ariseth a little cloud out of the sea, like a man's hand. And he said, Go up, say unto Ahab, prepare thy chariot, and get thee down, that the rain stop thee not. (45) And it came to pass in the meanwhile, that the Heaven was black with clouds, and wind, and there was a great rain. And Ahab rode, and went to Jezreel." *

The Scripture here presents us with a lifelike picture of the sudden coming up of a sub-tropical rain-storm. The rainy season generally commences in the land of Canaan early in October, and the winds usually blow at that time off the Mediterranean from the west—but when they fail the heat is excessive. † The King is obliged, as we read, to hasten his departure homewards, so that the torrential downpour, descending upon the thirsty land, and rapidly converting dry ravines and watercourses into raging torrents, may not stop him on the way. It is a phenomena always most impressive to a traveller when witnessed in its full intensity for the first time.

* *I. Kings*, Ch. xviii, verses 41 to 45 inclusive.
† Calmet's *Dictionary of the Bible*.—Article "Canaan."

Further to the southward, in the Desert Zone, these sudden storms frequently come up, accompanied by threatening masses of clouds, sometimes of inky blackness, and wind squalls of excessive violence: but nevertheless the rainfall itself fails; or perhaps a few heavy drops only are all that descend. These phenomena are very common in Upper Egypt and Nubia, and upon the Red Sea, during the winter season.—The German traveller Dr. Klunzinger supplies us with a good description of one of these storms, witnessed by him at the desert port of Koseir (Lat. 26° 6′24″ N.) on the eastern seaboard of Egypt.

"On such occasions (he tells us) it is by no means uncommon for the greater number of vessels in the harbour to be wrecked. One can foretell the approach of such a wind by the rise of a small white cloud, in the eastern horizon, after a period of almost perfect calm: a slight breeze, gradually increasing in strength, then rises; the suspicious little cloud approaches with astonishing rapidity, and in a brief space a raging, howling tempest prevails." *

The resemblance between the coming up of this storm, and that described in the Book of Kings, in every respect, except as regards the rain, will doubtless strike the reader: but we must remember that the one at Koseir occurred in what may be regarded as a practically rainless region. In the equatorial zone, the same phenomenon is constantly witnessed, accompanied not only by torrential rains, but also generally by heavy thunderstorms. The following is a description of one witnessed at sea, in the "Doldrums" or belt of equatorial calms—

* *Upper Egypt, Its People and Its Products*, by C. B. Klunzinger, M.D., formerly Egyptian Sanitary Physician at Koseir, 1878, p. 289.

"As we were passing the equator, we suffered from a tremendous thunderstorm. The heat was excessive, not a breath of wind stirring the air. About twelve o'clock a little cloud, about the size of a man's hand, rose in the horizon; gradually it spread, until it hung like a huge mass over the ship. I stood and watched its increase, when suddenly a vivid flash of lightning shot from the heavens and almost blinded me; at the same moment a crash of thunder bellowed round the ship, like the noise of a thousand cannons. The rain now descended, not a sharp, thick shower, such as you may witness in England, but, as it were, all in one mass, and soon every trace of the storm had passed away; the sun burst forth, and the ship and the sails were dried in the course of a few moments." *

Rain, as we are accustomed to see it in the temperate zones, gives us no conception of the violence of these tropical downpours, when the water descends not in drops, but in streams; as if "all the fountains of the great deep were broken up, and the windows (or floodgates) of Heaven were opened." † The ancient Hebrews in fact imagined rain to be derived from great reservoirs in the heavens which Moses refers to as "the superior waters." §

These rains are often of such excessive violence as to be in themselves one of the principal factors in the creation of deserts, for wherever the ground is not perfectly flat these torrents soon strip off all vegetable soil, and thus in a few years destroy that which has been the work of centuries. Nature, for this reason, has very generally clothed these regions with forests, which, however, man, in certain cases, has thought fit

* *Popular Account of the Manners and Customs of India*, by the Rev. Charles Acland, 1847, p. 2 (description of the voyage out).

† *Genesis* vii, verse 2.

§ See Calmet's *Dictionary of the Bible*, p. 856—article "Tents."

to destroy, with the above result. Irremediable harm has been done to some countries in this way.

We shall endeavour to give some idea of the enormous quantity of water which sometimes falls in these torrential rains, within a very brief space of time.

In Calcutta, for instance, on May 10th 1835, 16 inches of rain fell in twelve hours*—and on the authority of Mr. Yule, it is stated that on the Khasia Hills, in the month of August 1841, 264 inches, or twenty-two feet of rain fell, and that during five successive days of that time 30 inches fell in every twenty-four hours;† in other words as much rain fell on each of those days, as falls in most parts of great Britain in a year.

Sir James Martin, writing on this subject, says that, "It is in the Burmese territory that we find the most surprising examples of great falls of rain—those who served at Rangoon, and in Upper Ava, will never forget the rainy season in those countries," and quoting from an article in the Calcutta Review, describing the Khasia Hills, he cites the case of the station of Chirrah-Poonjee, where according to Professor Oldham the rainfall of 1851 amounted to *592 inches*, or *within 8 inches of a depth of fifty feet of water.* § It would be easy to quote further examples of great rainfalls, but these extracts from the standard work of this well-known Indian medical authority are, we think, sufficient on this point.

But it is sometimes at great distances beyond the

* *The Influence of Tropical Climates in Producing Disease*, by Sir James R. Martin, 2nd. edit., 1861, p. 32.

† *Ibid.*, p. 32.

§ *Ibid.*, p. 32.

locality where these rains themselves have fallen, that their most extraordinary effects are to be witnessed. Without a moment's warning sudden floods of the most dangerous and appalling character are created, which, as if by the bursting of the dam of some immense reservoir, carry destruction and death in their course. Disastrous floods, in fact, very constantly follow the breaking up of long droughts. This was so after "the first great Indian famine and drought of which we have any record, which devastated the lower valley of the Ganges in 1769 and '70, when one third of the population are credibly reported to have perished." * In Australia also, and other places, alternately with droughts there have been disastrous floods. The whole course of Nature in fact is a system of compensation and adjustments—all her operations seem to be carried on with a sort of rhythmical cadence, like the beat of some gigantic pendulum: and if the pendulum at any time is pushed too far in one direction, almost certainly the return swing will go too far in the other.

We shall now proceed to cite some instances of these sudden floods. Generally they have been preceded by drought; not a drop of rain has fallen, and perhaps not a cloud has been visible in the sky; and yet, without the slightest warning of any kind, floods have suddenly swept down the watercourses, on account of torrential rainfalls further up the country.

One of the most remarkable instances of the kind is one related by Sir Samuel Baker, of the coming down of the great River Atbara in the Soudan desert. It occurred on the night of June 23rd, 1861. For months

* *Encycl. Brit.*, 9th edit., Vol, xii, p. 767.

previously, not a single drop of rain had fallen and the drought was extreme. The heat of the previous day had been intense: the fiery breath of the Simoon being almost overpowering—while the sky as usual was unflecked by a single cloud. The only water in the river consisted of detached pools occurring here and there in the midst of a bed of burning sand.

The following is the substance of Sir S. Baker's narrative:

"The cool night arrived, and at about half-past eight I was lying half asleep by the margin of the river, when I fancied I heard a rumbling like distant thunder: a low uninterrupted roll appeared to increase in volume. Hardly had I raised my head to listen, when a confusion of voices arose from the Arabs' camp, shouting in the darkness, 'El Bahr! El Bahr!' The River! The River! (literally 'The Water'). We were up in an instant, and my interpreter, in a state of intense confusion, explained that the river was coming down, and that the supposed thunder was the roar of approaching water. Many of the people were asleep on the clean sand on the river's bed—these were quickly awakened by the Arabs. Hardly had they descended, when the sound of the river beneath told us the water had arrived. All was darkness and confusion. The great event had occurred, the river had arrived 'like a thief in the night'—on the morning of the 24th June I stood on the banks of the noble Atbara River, the wonder of the desert! Yesterday there was a barren sheet of glaring sand, with a fringe of withered bush and trees on its borders, that cut the yellow expanse of the desert. For days we had journeyed along the exhausted bed; no bush could boast a leaf; no tree could throw a shade—crisp gums crackled upon the stems of the mimosas; the sap dried upon the burst bark, sprung with the withering heat of the Simoon. In one night there was a mysterious change—there was no drop of rain,—no thundercloud on the horizon to give

hope, all had been dry and sultry; dust and desolation yesterday—to-day, a magnificent stream some 500 yards in width, and from fifteen to twenty feet deep, flowed through the dreary desert. Bamboos and reeds, with trash of all kinds, were hurried along the muddy waters. Where were all the crowded inhabitants of the pools? The prison doors were broken, the prisoners released, and rejoicing in the mighty stream of the Atbara." *

The causes of this extraordinary flood are not difficult to determine. As Sir S. Baker explains—"This sudden creation of a river was but the shadow of the great cause—The rains were pouring in Abyssinia! These were the sources of the Nile." †

These strange and wonderful events are, however, more common than people might be disposed to imagine, and in some countries it is a matter of serious risk to encamp upon dry river beds. These situations present considerable attractions to travellers, as a place of encampment, on account of the general absence of insect pests and the clean expanse of dry level sand that is often found in such places. We cannot, however, too emphatically warn travellers to beware how they indulge in this dangerous practice. The German traveller Dr. Barth, who was for some time in command of the British Government Exploring Expedition, in North Africa, from 1849 to 1855, relates the fact that their camp in the Sahara was on one of these occasions nearly swept away by the occurrence of one of these sudden floods, through camping in a ravine during heavy rains, and though the valley was

* *The Nile Tributaries of Abyssinia*, by Sir Samuel W. Baker, 1867, pp. 51 to 53.

† *Ibid.*, p. 51.

half a mile wide he informs us it was soon turned into a rapid torrent. *

Almost all parts of the great prairies of North America and the karroo regions of South Africa are also liable to be visited by terrific rainstorms, which give rise to floods of the most dangerous character, which take place without the slightest warning of any kind. These cloud-bursts occur suddenly, in the midst of a spell of the finest weather, when perhaps there has not been a drop of rain for weeks. Colonel Dodge, U.S.A., gives us a graphic description of some of these phenomena in his delightful and instructive work, "The Hunting Grounds of the Great West."

"They are so severe," he tells us, "that they have the general name of waterspouts. The quantity of water poured from the clouds and the effects produced are so apparently incredible that I would hesitate to describe them, but that the facts are perfectly well known to every prairie man. These storms generally occur in the afternoon of a sultry day, and in gathering and coming up have all the appearance of an ordinary thunderstorm. The rain, however, does not fall in drops, but in streams. They present the appearance of sheets, or waves, of water, and when the deluge of rain is, as is often the case, accompanied by huge rounded lumps of ice, they become really very serious. Men can generally find means of protecting themselves—though I have seen them pretty badly beaten—but animals are sometimes severely injured, and always rendered frantic, by the pounding.—If a storm overtakes a party on the march, the animals should be unhitched at once, and taken to cover, if any be near: or if there be none, most securely fastened to the waggons.—If in camp every precaution should be taken,

* *Travels in North Africa*, by Dr. Barth, Vol. i, pp. 325—26 (published 1857, London).

not only to secure, but to protect them. Every approaching storm should be regarded as a possible waterspout, and full preparation made to meet it. The effect of such a quantity of water, poured out upon the high plains, and rushing into the ravines, can more easily be imagined than described.—Depressions in the surface, scarcely noticeable in dry weather, become in a few minutes raging torrents; ravines ordinarily dry, become impassable rivers; and valleys, even though one or more miles in width, are flooded to the depth of many feet. Fortunately these storms are restricted in area, but unfortunately their disastrous floods are not confined to the vicinity of the occurrence. The flood moves on, carrying trouble, delay, suffering, and loss of life in its turgid waters, until they are finally lost in some of the great rivers of the plains. *

The most likely season for the occurrence of these storms, Colonel Dodge says, is during the months of June and July; but they may occur at any time of the year. People may, however, spend a long time camping out upon the plains, upon the borders of streams, and so forth, without any accident. This tends, as he points out,

"to carelessness, and sooner or later meets its reward, if not in actual loss, at least in a thorough drowning out"—"but the most careful plainsman cannot always be prepared for thunder from a clear sky, nor arrange for a flood when not a cloud is to be seen."

These events become, however, still more serious, if they take place in the night time, as they often do, when the wearied travellers are wrapt in slumber, and have turned in, totally unsuspicious of evil. Colonel Dodge thus describes one of these nocturnal floods occurring to his military camp—

* *The Hunting Grounds of the Great West*, by Col. Richard I. Dodge, U.S.A., 1877, pp. 81—83.

"My company was encamped on a bluff about 25 feet high, at the foot of which was the dry sandy bed of a stream—the bed averaged about 100 feet wide. The opposite bank was low, and from it the ground extended away in a broad bottom, to meet a line of hills.—About eleven o'clock on a clear, bright, beautiful, starlit night, I was lying reading in my tent, when I heard a distant roaring, rushing sound, gradually swelling in power. Guessing at once the cause, I rushed out, and placed myself on the edge of the bank, overlooking the sand.—In a few moments a long creamy wave crept swiftly, with a hissing sound, across the sand; this appeared to be only a few inches deep. Following it at a distance of about 60 feet was a straight, unbroken mass of water, at least four feet in height—a perfect wall of water. From this the mass gradually rose to the rear, covered with logs and débris of all kinds, rolling and plunging in the tremendous current. In 10 minutes from the passage of the advance wave, the water was at least 15 feet deep, and the stream nearly half a mile wide.—It was three days before this stream was fordable, and fully a month before it returned to its normal condition." *

The wisdom of the old traveller's maxim, always if possible, when upon the march, to cross a stream immediately upon arriving upon its banks, before encamping for the night, is made apparent by this anecdote—because if a freshet should occur during the night, its passage may be impracticable the next day, and you may have to wait a considerable time before its waters, on subsiding, render the ford possible. The danger of passing fords when rivers are in flood, has been proved only too often.

Another event of the same character is recorded, in which the sufferers were the 3rd Regiment of Infantry,

* *The Hunting Grounds of the Great West*, p. 83.

U.S.A., who were encamped upon the river Salado, near San Antonio, Texas, just after the close of the Mexican war of 1849:—

"The stream was then a thread, over which it was easy to step."—"In the small hours of the morning, when the camp was buried in repose, a sentinel nearest the stream found his coat covered with water. The night was perfectly clear, though dark; and for a few moments he sought in vain for the cause. Hearing a rushing sound towards the stream, he noticed that its bed was bright with running water; and on approaching, he found it already more than bank full, and that he was walking in the water of an approaching freshet. Discharging his musket, he alarmed the camp. Everybody tumbled out of bed, and, to their astonishment, into the water. All was alarm and commotion. The water rose steadily, but with wonderful rapidity; and the men were directed to make their way to the high land, as best they could; horses were brought, and the ladies, laundresses, and children carried on their bare backs, over nearly two miles of water, often up to the horses' bellies, before arriving on the safe high ground. Not a thing was saved: nearly all the command were in their night clothes. Tents, provisions, arms, everything, was carried down by the stream and totally lost. The bottom was so wide that the water was nowhere deep, and only one life was lost. The next morning the thread of a stream of the night before, was a mighty river, twice as wide as the Mississippi at Memphis." *

The moral of all this, of course, is, never to encamp close to the banks of dry stream beds, but if possible to chose a location well raised above the reach of the water, in case of a possible flood. In all probability it was only the wide, flat nature of the valley that in this case, saved the lives of the whole command. That

* *The Hunting Grounds of the Great West*, pp. 85, 86.

this is not at all an exaggerated supposition, will be apparent from the following still more serious and fatal disaster, which overtook Company F. of the 3rd U.S. Cavalry on the 31st of May, 1873, in the valley of Blackwood, in the State of Nebraska. It is an abstract taken from the report of the Captain, which is quoted at length in Colonel Dodge's work—

"About 9 p.m. a terrible freshet without any apparent cause swept down the valley, carrying everything before it. Men, horses, tents, army waggons, were swept along like corks. For five days previous we had had no rain, and where all this water came from so suddenly, I cannot yet understand. The valley of Blackwood is about 45 miles long, and about 1 to 1½ miles wide. This entire stretch of country was one raging torrent, from six to seven feet deep, and how any man or horse escaped, is marvellous. The only thing that prevented total destruction, was the fact that my camp was surrounded by timber, and as the men were carried off, they were enabled to save themselves by catching the limbs of trees. When day broke on the first of June, it showed almost all the men of my company on the tops of the trees, without any covering except the remnants of underclothing, and beneath them, the torrent still raging. After the lapse of a few hours the water began to fall, and a few men who could swim got to the hills. Afterwards the others, and myself, were got off by various other means. Six men were drowned, and twenty-six horses lost."

The commanding officer of the regiment, at Fort McPherson, in his endorsement of this report, remarks, "Nothing but the courage and coolness of Captain —— and his non-commissioned officers, prevented the loss of the entire command."*

These extracts, collected from Colonel Dodge's book,

* *The Hunting Grounds of the Great West*, pp. 87, 88.

are, we think, sufficient to show the sudden and terrible nature of some of these floods, which, as we have said, are more common in the interior of great continents throughout the world, than people would suppose. They are frequent in South Africa for instance. The torrential rains of the inter-tropical zone being in these cases carried far up the country—probably because of the quantities of heated air cast up from the surface of these great plains; all over which, the solar rays are felt with great intensity of power.

And if in answer to the very natural questions: From whence do these immense quantities of water come? and, Why do they fall so suddenly? we might venture to hazard an opinion upon matters so apparently unaccountable, we should be inclined to reply, That in the first place, what seems to be clearly taught us by these occurrences is that the marvellous water-bearing capacity of the winds is practically inexhaustible, because of the diffusion of aqueous vapour through space—and lastly, that the less obvious phenomenon of its sudden condensation in these enormous quantities is probably due to the great radiation of solar heat, so often experienced in the plains country, which causes the vapour-laden winds to flow onward without depositing their due proportion of water, until, after excessive accumulation, some sudden cyclonic eddy of cold atmosphere occurs to precipitate it.

The area of these disturbances is sometimes restricted to very small proportions, as is conclusively proved by the following incident, which occurred at Paris, on the afternoon of May 21st, 1891, when—

"A waterspout formed near the centre of the Champs Elysées, and gyrating in its descent over the Place de la

Concorde, burst in the Jardin des Tuileries, where it tore up three of the largest chestnut trees in the grounds, and did serious damage to many other trees. While the storm was at its height, a thunderbolt fell upon the Esplanade des Invalides, but nobody was injured."*

The prevalence of electrical phenomena, concurrently with these waterspouts, deserves special notice; though we fear it would be rash to hazard an opinion as to how far the atmospheric disturbances may be influenced by them—but that they exercise material effect is a fact that can hardly be doubtful.

In the British Islands we can form literally no idea of the terrific nature of the thunderstorms which take place in some parts of the world: although we occasionally do have what in England we regard as severe storms of this nature, during which accidents sometimes happen both to man and beast—also to buildings, by being struck by the electric fluid. Fortunately, however, these occurrences are comparatively rare. Both in number and severity they are as nothing compared with the frequent accidents of this kind which occur abroad; where the electricity seems to run along the ground and plays all sorts of curious pranks. We have seen thunderstorms, for instance, where for some hours the roll of thunder has been almost continuous, and blinding flashes of lightning have followed each other in rapid succession, almost the whole time. The thunder on such occasions really resembles the discharge of heavy artillery; and at the crisis of the storm, when it is exactly overhead, the claps follow instantaneously upon the flash, with an explosion which

* *Morning Post* of May 23rd 1891, "From our own Correspondent, Paris, May 22." (N.B.--Similar paragraphs appeared in all the London papers).

exactly resembles the firing of a piece of ordnance, followed by the peal of thunder which is broken in upon by the succeeding crash before its reverberation has ceased. We have sometimes seen such storms work right round the compass, and return overhead two or three times, before ceasing, as if moving in a great circle.

The wonderful thing is not that so many accidents occur, but that one escapes at all, on such occasions, when the electricity seems to be all round one, and the very heat of the flash sometimes seems to be quite distinctly felt upon the face. Yet the danger is more apparent than real, for as a rule, people in general get off quite safe. Mr. Selous, however, mentions a case, where two travellers were struck by lightning whilst sitting in their waggon, on the plains of the Transvaal—one recovered, but the other was killed upon the spot. * On another occasion during a storm, a number of cattle were instantaneously killed, by the lightning striking a tree under which they were taking shelter.

"Suddenly" (Mr. Selous says), "I saw splinters fly from a tree about sixty yards off, whilst all the cattle standing beneath it, fell to the ground. On going up to see what had happened, I found thirteen fine oxen lying killed. Most of them must have had their heads down, feeding, and had fallen so suddenly, that their heads were bent under their bodies. I turned all the carcases over, but could find no mark of any kind on them." †

We might proceed to multiply instances of disasters which have occurred throughout the world, caused by

* *Travels in S.E. Africa*, by F. C. Selous, 1893, p. 448.
† *Ibid.*, p. 447.

thunderstorms; but they would merely be a repetition of similar scenes, recounted with fresh details. We may, however, say that in South Africa, what are called "dry storms," that is to say thunderstorms unaccompanied by rain, are generally considered more dangerous, and are much more dreaded than the common form with torrential rain. The whole of the "karroo country" is subject during certain seasons to the occurrence of tremendous thunderstorms, and in some of the drier regions the greater part of the rainfall of the year occurs during the prevalence of the summer thunderstorms.*

The exceedingly dry climate of South Africa seems to be peculiarly favourable to the exhibition of electrical phenomena, and during the summer heats nearly every evening after sundown brilliant displays of sheet lightning may be witnessed, which last well into the night. The scenic effects are often splendid and sometimes resemble, in the constant play of fire, the appearance of a city burning in the distance. The delicious temperature of the nights is at this time most charming. The sheet lightning is not accompanied by rain: there is no dew; and in these dry regions one can sit out under the brilliantly starlit sky, without the slightest risk from damp, to any hour that may be desired, enjoying the most delightful repose.

According to the guide-books Natal seems to be peculiarly subject to heavy and sudden thunderstorms which sweep over the country during the hot months; we were not, however, ourselves long enough in that colony to be able to express an opinion as to this; but it is stated, that—

* Brown's *South African Guide*, 1893, p. 41.

"the annual average of such storms is 97, of which the great majority occur in summer, and the lightning is far more brilliant and dangerous than in England; seared patches of grass many yards across may frequently be observed where the electric fluid has struck the ground, and several head of cattle are occasionally killed by one flash." *

Our own experience with cattle and other domestic animals, during severe storms of this nature, is that they cease feeding, and generally draw together in groups for protection, where they stand with their heads down, very often around the base of some large tree, when there is one at hand; and thus these accidents, when numbers are struck dead, as related in the case mentioned by Mr. Selous, are comparatively common in many parts of the world.

The whole of the great prairie regions of America, for instance, are subject to violent thunderstorms, and one of the severest that we have ever witnessed burst over a party under our command, while far out in the great Indian country, beyond the frontier settlements of the whites, shortly before the War of Secession. In our East Indian Empire also, tremendous thunderstorms are common; those which generally accompany the bursting of the monsoons being sometimes of an appalling character. We think it quite worth while to reproduce here the account of one of these events, graphically described by the pen of Mr. Mountstewart Elphinstone, at the beginning of this century. He says—

"The most remarkable rainy season is the S.W. monsoon. In the south of India, this commences about the beginning of June, but it gets later as we advance to the north. Its approach is announced by vast masses of clouds that rise

* Brown's *South African Guide*, 1893, p. 47.

from the Indian Ocean, and advance towards the N.E., gathering and thickening as they approach the land. After some threatening days, the monsoon generally sets in during the night. It is attended by such a tremendous storm, as can scarcely be imagined by those who have only seen that phenomenon in a temperate climate. It generally begins with violent blasts of wind, which are succeeded by floods of rain. For some hours lightning is seen almost without intermission, in vivid and successive flashes which exhibit objects in all the brightness of day. During all this time the distant thunder never ceases to roll, and is only silenced by some nearer peal, which bursts on the ear with a sudden and tremendous crash, as can scarcely fail to strike the most insensible heart with awe. To persons who have long resided in India these storms lose much of their grandeur, yet they sometimes rise to such a pitch as to make an impression on those most habituated to them. I have been told by a gentleman who had been some time in Malabar, the province most distinguished for the violence of the monsoon, that he heard a clap of thunder which produced a silence of a minute in a large party of officers, and made part of the company turn pale. At length the thunder ceases, and nothing is heard but the continuous pouring of the rains, and the rushing of the rising streams. This lasts for some days, after which the sky clears, and discovers the face of Nature changed, as if by enchantment. The earth is covered by a sudden, but luxuriant verdure; the air is pure and delicious; and the sky varied with clouds. From this time the rain falls at intervals, for about a month; when it comes on again with great violence; and in July the rains are at their height. During the third month they rather diminish, but are still heavy, and in September they gradually abate, and are often suspended till near the end of the month, when they depart amidst thunders and tempests, as they came." *

* *Account of the Kingdom of Cabul*, etc., by the Hon. Mountstewart Elphinstone, 2nd edit. 1819, Vol. i, pp. 203 to 206.

This account of Mr. Elphinstone gives a capital general idea of the phenomena which attend the bursting of the Indian monsoon, and the onset of the rainy season, in tropical climates: an event which almost always leaves a vivid recollection upon the mind of the thoughtful traveller, though long years may have elapsed since he witnessed it: the feelings of awe, which the grandeur of the spectacle produces, being mixed with those of wonder as to where all these enormous stores of water can come from.

Some curious details respecting the causes of these torrential rains, have been handed down to us from the dawn of history.

At a remote period of antiquity, according to Augustine Calmet—a learned Benedictine of the College of St. Vannes—(among other authorities) the ancient Hebrews appear to have entertained the belief that rain was derived from certain great reservoirs "above the heavens"; to which Moses is supposed to make reference, in the Sacred Writings, as "the Upper," or "Superior Waters," which were supposed to exist above the firmament; in contradistinction to the lower, or inferior waters, of the terrestrial sea. *

The "*firmament*" in those early days was supposed to resemble an immense and solid arch, as indeed the word itself implies. †

This formed the vault of heaven, and served as a barrier between the upper and lower waters, and in

* Calmet's *Dictionary of the Bible*, translated from the French, 14th edition, 1861. Edited by the late Chas. Taylor. P. 856, article "Rains." (The first edition published in Paris, 2 Vols fol. 1722—see *Bibliotheca Britannica*, by Robert Watts, vol. i).

† "Firmamentum," a support, prop, or stay; see Dr. Smith's *Latin Dictionary*.

it, the stars were fixed like so many precious stones set in gold or silver. *

Let us endeavour to point out how far these crude theories are modified, or explained, by the light of modern science.

That reservoirs do exist, containing supplies inconceivably vast, constantly stored up above us, is indisputable; and those who may have honoured us by an attentive perusal of the remarkable instances of heavy rain storms—related in the preceding pages, from the works of writers whose bona fides and accuracy are beyond question—will doubtless have been struck by the extraordinary amount of water which can, under certain conditions, be precipitated from above in a wonderfully brief space of time.

It is also necessary to bear in mind that however much these very exceptional rainfalls may excite astonishment, they proceed only from an infinitesimally small portion of the whole atmosphere, which as one of its normal conditions forms the conduit pipe, if we may so express it, which conveys every drop of water that fills the fountains, lakes, streams and great rivers of the world. Looked at in this light, we may perhaps partly realize the stupendous magnitude of the volume of water constantly floating above, and around us, in the form of vapour.

These therefore are "the superior waters"—their reservoirs are the winds of Heaven. But modern meteorological science teaches us that they exist not in the form of water, but as invisible and impalpable aqueous vapour—and that the same power which acts

* See Cruden's *Concordance*, article "Firmament"; also same art. in Dr. W. Smith's *Dict. of the Bible*, 1863, vol. 1, p. 621.

as its absorbing medium acts also as an elastic cushion, which is able to carry it along, notwithstanding its enormous bulk and weight—(of which no words of ours could convey an adequate idea)—as though it were no heavier than a film of spider's web. The winds therefore supply the place which the "firmament" was supposed to represent in the minds of the ancients.

The intelligent traveller, when he goes forth from our cloud-laden atmosphere to bask in the glorious sunshine and balmy breezes of a southern climate, may therefore constantly bear this in mind, that though the sky may appear spotless in its exceeding transparence and serenity, and is unflecked, it may be, by a single cloud, vast accumulations of water, such as we have here striven, in a very humble way, to give some idea of, are nevertheless perpetually floating overhead, throughout the whole expanse of the heavenly blue: unheard, unseen, unfelt, and even unsuspected, by the dwellers upon the earth beneath. Indeed, it seems probable that the azure blue of the sky itself is simply the effect of the solar rays transmitted to us through these immense masses of aqueous vapour. Water itself, even in its most crystal purity, being o a blue colour (ultra-marine)—but this colouring only becoming apparent, when viewed through the medium of masses of considerable volume.

Now, these enormous volumes of water are being at all times gradually exhaled from the terrestrial surface of the land, as well as from the entire liquid expanse of the ocean, as vapour, so subtle in its nature that in general it passes away in totally invisible form, so that it is only on rare occasions that the action of this mighty process is revealed to our eyes.

Nevertheless there are times when evaporation assumes palpable shape. Upon a winter's day in our own country, for instance, when a bright sun streams out after a night of severe frost, people walking in their gardens, or near soil that has been recently turned, may often see steam, rising in smoke-like wreaths from the surface of the ground. Occasionally to such an extent does this become visible, that it looks as if it was actually on fire. Go over, and put your hand into the steam, and the humid warmth, given off by the earth, can frequently be clearly felt!

Now, what is this but evaporation in visible form? such as is at all times going on around us, though we cannot see it. So again, when crossing the equatorial calms, in a ship at sea, when a shower of cold rain has recently fallen, the surface of the ocean may be seen to smoke, in an exactly similar way. We have seen this phenomenon very beautifully exhibited off the African coast, in the gulf of Guinea, during the great heats which prevail there.

The cause of this remarkable spectacle, in both the cases we have cited, is identical; namely, the invisible vapour, at the moment that it is given off and first mixes with the atmosphere, becomes partially condensed by cold, and so at once assumes a visible form:—in the first case, through contact with the frosty air, the immediate surface of the soil having been warmed by the bright sunshine; and in the second, by the chilling effect of the cold rain falling upon the heated surface of the glassy sea.

Such in brief is an outline of Nature's great design of the water-bearing winds and the uplifting of aqueous vapour to create the rains; grand and majestic, both

in its simplicity and magnitude. We hope also still further to follow up and explain in our survey of the climatic zones the wondrous phenomena which are there produced in the vegetable kingdom, by the united effects of heat and moisture.

Thus far, however, we have regarded Nature mainly in her calmer aspects; but this section would be incomplete without some notice of those great atmospherical disturbances, such as hurricanes and blizzards, or storms attended by the sudden onset of intense cold. Nature, our beneficent mother, ordinarily so soft and gentle in her operations, then becomes terrible in her destructive power—and yet this violence is not, as poets have sometimes described it, an access of unreasoning fury; for the ultimate action of all storms may be held to be restorative and beneficial, and may be regarded as the convulsive efforts of Nature to redress still greater evils, and to bring back into its normal condition those disturbances of the atmosphere brought about, occasionally, by a combination of untoward circumstances.

When the storm fiend, therefore, is unloosed, and the mighty winds have gone forth to threaten and destroy, we must be content to view it in this light. In the economy of Nature, severe storms may in fact be regarded as a paroxysm of disease, such as that which attacks our corporeal frames—acute disease, as we know, being by no means an unmixed evil to the suffering mortal; but rather a supreme effort of Nature to cast off from us those morbid conditions which menace our safety and existence. Very terrible and very destructive, however, these paroxysms of Nature sometimes become; and very fortunate we may

esteem ourselves, that in these sea-girt islands of Britain we are rarely or never visited by these great storms in their most dangerous form.

The tracks of hurricanes more generally seem to follow the area of extreme temperatures by sea, and the interior of great continents by land. There may be exceptions, and there can be no doubt that every part of the world *may* be visited by them, but we speak merely of the usual course of events in these cases. As a general rule the scenes of the most destructive hurricanes are almost always to be found in tropical regions, wherever in fact, as we have said, extreme temperatures prevail; but these disturbances are sometimes carried up for long distances into the temperate zones, wherever they traverse a wide extent of dry flat country.

The experience of cyclonic storms throughout the interior of the United States, for instance, seems strongly to point in this direction, because, as we know, the seaboard of that great country, in the temperate zone, is generally exempt from those visitations, which occur there in a severe form only upon rare occasions.

Some of the great cyclones which originate in the West Indies have been known, for instance, to travel as far north as the coasts of Newfoundland; thus the daily progress of one of the hurricanes of 1830 was traced—

"from near the Caribbee Islands, to the coasts of Florida and the Carolinas, and thence to the banks of Newfoundland, a distance of more than 3000 miles, which was passed over by this storm in about six days: the duration of the most violent portion at the different points over which it passed

being about 12 hours, but its entire duration was in many places more than twice that period." *

The literature bearing upon storms and hurricanes is most voluminous, and a catalogue of upwards of a thousand works, reports, and other papers devoted to this subject was published by Mr. A. Poey of Havana in 1865, † some of them dating back as far as the beginning of the sixteenth century, and many hundreds have since then been added to this long list.

But though the laws which govern these phenomena have been the subject of debate, in this way, for centuries, there still remain many points upon which the opinion of authorities is undecided.

It is, however, a well-ascertained fact that hurricanes have two distinct motions—the principal of which is of a revolving or gyrating character; and the other an onward and progressive movement; of this rotatory storm a miniature representation may frequently be seen in gusts or eddies of wind, carrying round with them bits of straw and dust, on any stormy day.

It is this whirling motion which is so terribly destructive, and which seems to act with continually increasing violence from its exterior margin inwards towards its centre, or vortex; at which point the terrible "lull of the storm" occurs, and a complete calm generally exists, with the sun perhaps still shining brightly by day, or the stars by night—whilst all around this central calm, is the dark bank of cloud where the hurricane is still raging in its greatest intensity. §

* *The Law of Storms Considered Practically*, by W. H. Rosser, 1876, p. 10. † *Ibid.* p. 2. § *Ibid.* p. 1, opening paragraph.

It would be foreign to the province of this work to do more than sketch a brief outline of this subject. It has, however, been "generally remarked, that the most active and violent storms are usually the most regular and uniform in the development of these characteristic movements, already described." *

And fortunate it is that this is so, because it has enabled a set of rules to be drawn up, showing how officers encountering one of these hurricanes at sea, can tell with comparative certainty whereabouts the vortex of the storm is passing, and then by following the instructions given, they can generally manage, even in a sailing ship, to run away from the approaching storm, so as to escape at all events from its most dangerous phases; for a vessel getting into the vortex of a hurricane of the worst description, we need hardly say, runs a very good chance of never being heard of again. The rules for ascertaining the probable position and course of hurricanes are given *in extenso* in various works on navigation; but a clear, short, and valuable account of these matters will be found, condensed into a few pages, in a naval pamphlet recently published at Portsmouth by Captain Jackson, R.N.,† to which those who are curious about such things will do well to refer. And in the "Compendium of Geography and Travel for Central and South America" the leading fact is set forth in a single sentence as follows—

* *The Law of Storms*, etc., by W. H. Rosser, 1876, p. 13.

† *The Principal Winds and Currents of the Globe, also Rainy Seasons, Ice Limits, Fogs, Rollers, and Revolving Storms*, by Captain Robert Jackson, R.N., 1890, published by H. Lewis, Portsmouth.

"When we turn our back to the wind, the Vortex will be *on our left* in the *Northern,* and *on our right* in the *Southern Hemisphere.*" *

The force of the wind is generally expressed by measuring its velocity per hour in miles; though to the ordinary mind this would give but a very indefinite idea of what it was intended to convey; and a true test will probably be found by reducing it to the pressure of the gale upon a given surface, such as a square inch, or square foot. All such comparisons, however, give merely an approximate idea of the enormous force which wind is capable of exerting on such occasions. In the West Indies, for instance, we have heard it asserted, on what seemed to be good and credible authority, that during the fiercest phase of a violent hurricane the wind has actually been known to blow men away, like bits of stick or branches of trees; and to dash them against rocks, † or whatever happened to stand in the way, killing them instantaneously; houses also of solid construction are frequently overturned, and wrecked as completely as if they had been bombarded by heavy artillery.

The area of rotation of some of the greatest of these storms has been estimated as an elliptical figure some 500 or 600, or even 1000 miles across, § and the velocity of the whirlwind as great as 140 or even 150 miles an hour. ** This speed, however, we are

* See the *Compendium of Geography and Travel for Central and South America,* by H. W. Bates, 1878, pp. 144—46.

† A case of this kind came under our notice in Ireland, during the great cyclonic storm of January 1884—a man named Gavin being killed in this way at Carn Hill, in the County of Monaghan.

§ *The Law of Storms,* by W. H. Rosser, 1876.

** *Ibid.*

inclined to think is overstated. But its progressive march is very much less than its rotatory violence, and it seems probable that these hurricanes do not travel forward at a greater speed than about 18 to 20 miles an hour—or say from about 430 to 480 miles a day; * and as the most violent hurricanes appear to shift their position more slowly than those of lesser intensity, it is therefore quite easy to see that it is possible for a powerfully engined ocean steamer to run right away from an approaching storm, provided its advance is foreseen in due time, and its true position is correctly estimated; and also provided, of course, she has sea room to run in the required direction. Thus the loss of the P. & O. ss. Bokhara, with nearly all hands, in the China seas on October 10, 1892, arose from her being caught in a narrow channel where there was no sea room, and so she was driven ashore. We ourselves knew the unfortunate ship and her officers well, as we have sailed in her.

The approach of a hurricane, we need hardly say, is always indicated by a rapid fall in the barometer, which shows only too clearly the serious nature of the atmospheric disturbance; and by the depth of the depression then passing in the zenith—so that there is now no excuse, in these enlightened days, for the storm breaking upon a ship unawares. Nevertheless, an unfortunate combination of circumstances may sometimes occur, which may put it out of the power of an officer to avoid the gale, in which case he must try and weather it as best he can. And we shall now

* This low speed of the *forward advance* of such storms is quite distinct from their *rotatory velocity*, which may be five or six times as great.

proceed to try and give a picture, so far as we can do, in mere words, of one of these terrible scenes.

One of the most terrific and destructive hurricanes upon record in the West Indies, is probably that which occurred in October 1780: the British Navy seems upon that occasion to have suffered more severely at the hands of the Storm King than ever she did from the united efforts of the fleets of France and Spain, and the rebellious colonists in America, with all of whom she was at that time at war; for on the day in question a splendid fleet was sent to the bottom, and 15 ships, mounting 482 guns, were lost to the Navy of England. It comprised the following vessels: Thunderer, 74 guns—Stirling Castle 64—Defiance 64—Phoenix 44—La Blanche 32—Laurel 28—Shark 28—Andromeda 28—Deal Castle 24—Penelope 24—Scarborough 20—Barbadoes 14—Chameleon 14—Endeavour 14—and Victor 10 guns.*

It is probable that this is the greatest naval disaster ever recorded as due to storm, except that of the Spanish Armada, in August and September 1588, whose loss was computed at about 35 ships and 13,000 men.† A medal was afterwards struck by order of Queen Elizabeth, commemorative of this event, which bore this significant motto—"AFFLAVIT DEUS ET DISSIPANTUR"§—and the same words may with equal justice be applied to the catastrophe which overtook our own fleet two centuries afterwards. When these mighty winds go forth upon their destructive

* *Haydn's Dictionary of Dates and Universal Information*—Article "Wrecks."

† *Ibid.*—Article "Armada."

§ Collection of Medals in the British Museum. [N.B. "The Opposition motto" of Spain was—"*Exsurge Deus, et Vindica Causam Tuam.*"]

course, both by land and sea, the puny efforts of man are but as a thing of naught. The history of the world is replete with instances of this. Fortunately for us, as we have already remarked, the British Islands are wonderfully exempt from these visitations; nevertheless they sometimes occur, as for instance in the case of what is known as "THE GREAT STORM," one of the most terrible that ever visited England, on the 26th and 27th of November, 1703; which there can be no doubt was one of these cyclonic tempests, similar to those which occur in tropical regions. On this occasion the devastation was terrific all over the country; the loss sustained in London alone being estimated at two million pounds sterling: and when we bear in mind the enormously greater value of the pound sterling in 1703, to what it now represents, this loss was simply enormous. This hurricane, as is almost always the case, was accompanied by torrential rains, and the loss of life by drowning, through the overflowing of the Thames, the Severn, and other rivers, was very great. Multitudes of cattle were also lost; in one district alone 15,000 being drowned. The loss of life in ships blown from their anchorages and never heard of afterwards, is thought to have been 8000;—twelve men-of-war, with more than 1800 men on board, were lost within sight of their own shore—and it is estimated that 17,000 trees were torn up by the roots in the county of Kent alone; the Eddystone lighthouse was destroyed, and in it, its architect, Winstanley, and those who were with him, all perished.* Such was the upshot of a twenty-four hours' gale in England.

* *Haydn's Dictionary of Dates and Universal Information.*—Article "Storms."

Then, coming down to our own time, we have the great cyclone of 1876 in India, when one of the most frightful catastrophes ever recorded in any country took place on the night of October 31, 1876, in the estuary of the Brahmaputra:—

"At midnight a furious wind drove the sea water into the estuary, thus banking up the river for many miles. The wind then circling round, after the manner of cyclones, brought its force to bear on the accumulated mass of river water, driving it seawards. Thus there was a tremendous refluence of the flood, placing hundreds of populous villages under many feet of water, and *more than 100,000 persons* were drowned in the darkness of that night." *

When the morning broke the retiring waters disclosed a scene of death, ruin, and desolation; a good many persons saved themselves by climbing into trees, but all the rest of the population, cattle, and live stock of all kinds, lay dead, throughout the entire area of the submerged district.

Still more recent is the terrible hurricane at the Mauritius, which occurred on the 29th of April, 1892, and was one of the most destructive wind storms ever known.

"1100 people were killed by it, and 2000 wounded. One-third of the capital (Port St. Louis) was levelled to the ground, and 30 out of 50 churches were demolished. Whole villages were swept away, and some 50,000 people left homeless." †

In this case it is stated that the result of observations shows

* *India in 1880*, by Sir R. Temple, 1881, p. 380.

† *The Cyclone of April 29 in the Mauritius*, by Robert E. H. Jermingham, C.M.G., Lieut.-Governor of Mauritius; in Blackwood's Magazine for September 1892, pp. 342—347.

"that the velocity of the wind was 121 miles an hour, at its maximum, which corresponds with a pressure of 67 lbs. to the square foot." *

So far as we can ascertain, this appears to be the highest velocity ever recorded, from actual observation, and the enormous force it represents was clearly sufficient to actually blow men away like chaff; and it was therefore not surprising to learn that in fact, it did "carry all before it."—"In Port St. Louis whole streets were literally swept away, about 3000 houses being destroyed." †

So extensive and severe was the distress occasioned, that upon the intelligence reaching England, public subscriptions were at once raised for the relief of the sufferers; a special fund being collected by the Lord Mayor of London, at the Mansion House, for that purpose, upon receipt of dispatches from Lord Knutsford, Secretary to the Colonies, in which he says that the disaster was "if anything, greater than the first news led me to believe, and demands all the help the friends of the colony are able to afford it in this calamity." §

In Blackwood's Magazine for September 1892, a graphic description of the terrible scene is given by the Lieut.-Governor of the Mauritius, well worth perusal.

"The wind (he says) blew N.E. by E., at 22 miles an hour, at 6 a.m. At noon its direction was N.E. ½ E., and

* *The Cyclone of April 29 in the Mauritius*, by Robert E. H. Jermingham, C.M.G., Lieut.-Governor of Mauritius; in Blackwood's Magazine for September 1892, pp. 342—347.

† *Times* report in paper of June 3, 1892.

§ Extract Letter of the Secretary to the Colonies to the Lord Mayor of London, in *Times* of June 3, 1892.

its velocity 68 miles an hour; while at 1 p.m. its velocity had reached 96 miles, indicating hurricane fury—but at 2 p.m. (the Barometer still falling) it lulled to 56 miles, at the observatory, where the centre of the storm did not pass, and *to two miles in the centre* (that is almost a dead calm)."

The lull of the storm is thus described:

"Between the gusts had always been those silent moments, more terrible than the gusts themselves, which characterize a cyclonic storm, as if the wind gathered its strength to strike each blow more deadly than the last." *

The awful calm of the vortex seems to have passed about 2.30 p.m.—

"Suddenly (we are told) the roar ceased, the hissing sank to a whisper, a calm succeeded the storm, and a haze like a November fog filled the air. Cautiously a door was opened, and we stepped out and looked round—and one exclaimed —'This is the centre'—and another 'Mind what follows'. At 4 p.m. a boom like that of a hundred-ton gun, resounded, and the battle raged anew, though the centre had passed." †

It was at this moment that the velocity of 121 miles an hour was registered, and from thenceforward, as the cyclone moved onwards, the storm abated, until 8 or 9 p.m. when it was at an end. "Never (we are assured) did a more glorious day shine, than on the morrow of the 29th of April." §

The storm fiend had passed by; and the work of collecting the dead and wounded remained to be taken in hand, exactly as upon the field of action, after a great battle; and before the close of that day—

* *The Cyclone of Mauritius*, in Blackwood's Magazine of September 1892.

† *Ibid.*

§ *Ibid.*

"the cathedrals, town hall, barracks, etc., had all been turned into hospitals." * The loss of life in this storm, for instance, was actually more than twice as great as that of the allied British and French armies at the battle of Inkerman, and the number of wounded was also considerably greater, though this was one of the fiercest battles fought during the present century. †

The "Blizzard," or gale attended with intense cold, is another description of storm which deserves at least a passing notice before we close this branch of our subject. These storms are very common throughout the plains regions, in the interior of North America and other great continents, during the winter season; and frequently come on quite suddenly, during a spell of otherwise fine and mild weather; and although the wind does not blow with the extreme violence which characterizes the cyclonic disturbances of tropical climates in summer and autumn, they often occasion intense suffering and much loss of life, both amongst men and animals. At the first indication of the coming of one of these storms in wild regions, the plains animals and birds fly before the icy blast and seek refuge in the ravines and coverts—whilst man himself, and the domestic animals, caught out upon the open plain away from the neighbourhood of shelter, in a really bad storm of this kind, are very apt to be frozen to death—or at least to sustain severe mutilations, such as loss of hands or feet, by frostbite. The losses of

* *Times* of June 3, 1892.

† *Haydn's Dictionary of Dates and Universal Information* states that "The loss of the allies was 462 killed, 1952 wounded, and 191 missing" (see Article "Inkerman").

stock sustained by farmers and others on these occasions, are often exceedingly severe, horses and cattle being frequently frozen to death in large numbers. Even so far to the southwards as Texas these storms occur at intervals with great intensity, and are sometimes very destructive. In consequence of the wind being generally from the northward they are there known as "Northers" and are much dreaded by residents upon the plains, no part of which seems to be exempt from their visitations. Throughout the whole extent of the western prairies blizzards, attended by disastrous consequences, occur during almost every winter and—"in the worst storms it is almost impossible for any man to be out." They are pretty nearly always accompanied by heavy snow, whereby landmarks are quickly obliterated, so that a man unfortunate enough to be overtaken by a bad blizzard, upon the high plains, without a compass, is very apt to lose his way and wander about in the blinding snow drift, until overcome by cold and exhaustion. A strange fact connected with these cases being "that men found dead had evidently gone mad before dying, and stripped themselves of their clothes; about half the bodies being found nearly naked." *

It seems hard at first sight to account for this remarkable circumstance, but cold affects people in a variety of different ways, and one of the effects of great cold, as we know, is to produce an overpowering tendency to sleep. The brain feels as if frozen: the mind and memory quickly become affected; the person reels about as if intoxicated; and violent deli-

* *Ranch Life*, by Theodore Roosevelt, 1889.

rium sets in.* And it may be that these unfortunates removed their clothing under the influence of delirium, which created the impression that they were going to bed. Before sensation becomes destroyed by cold, also, severe burning pains are often felt in the limbs, it is therefore possible that in some cases the clothes are cast off in an effort to obtain relief from those pains; the individual thus himself completing the work which the icy gale has begun, and so quickly falling a victim to his own disordered fancies.† However this may be, there can be no doubt as to the fact that persons frozen to death *do* frequently strip themselves in this way, the circumstance being well known throughout the north western plains region of America, where we ourselves have frequently heard plainsmen relate instances of it, which had come under their own observation. In other cases the position of the bodies showed that death had come during sleep: in the passes of the Andes, for instance, where loss of life from cold is of frequent occurrence. According to Lieutenant Brand, "many persons are found dead in the snow with their heads reclining on their arm, just as they had died, so easily does the King of Terrors come over them." §

In these instances it is evident that the tendency to sleep had become irresistible, and that settling themselves to rest, as if about to take their natural repose, they had passed from the sleep of time into that which knows no wakening.

* See *Quain's Medical Dictionary*, 1883. Vol. i, p. 271.

† See *Seas and Skies in many Latitudes*, by the Hon. Ralph Abercromby, F.R.M.S., 1888, p. 7.

§ *Voyage to Peru and Journey across the Andes, in 1827*, by Lieutenant Charles Brand, R.N.

Very great losses, as we have said, are frequently caused by these terrific gales, which are known as "blizzards" in the United States. Captain Marcy, U.S.A., in his "Prairie Traveller" for instance states that, "while passing near the head waters of the Colorado in October 1849, he was overtaken by one of these storms. He tells us that he left the camp

"at an early hour in the morning, under a mild and soft atmosphere, with a gentle breeze from the South, and had marched only a short distance when the wind suddenly whipped round to the North, bringing with it a furious chilling rain, and in a short time the road became so soft and heavy as to make drawing the waggons very exhausting for the mules, and they came into camp in a profuse sweat. They were turned out of harness into the most sheltered place that could be found; but instead of eating, as was their custom, they turned their heads from the wind and remained in that position, chilled and trembling, without making the least effort to move. The rain continued with unabated fury during the entire day and night, and on the following morning 35 out of 110 mules had perished, while those remaining could hardly be said to have a spark of vitality remaining, and could with difficulty walk."*

In this instance it will be observed, that the storm was accompanied by rains, instead of, as is more commonly the case, by snows; it is therefore clear that it was not a blizzard of the most severe kind or one accompanied by a very high degree of intense cold—and yet the loss, in a single night, amounted to about one third of the animals drawing their waggons—a ruinous loss to a military transport train. Exposure

* *The Prairie Traveller*, a handbook for Overland Expeditions, by R.M. Marcy, Captain U.S.A., p. 57, Section on "Storms." (Published New York, 1859).

upon the open prairie, to the full force and fury of a violent plains Norther, Colonel Dodge tells us, after 30 years experience of life upon the plains, would in his opinion—

"be certain death to any indigenous animal. Buffalo and antelope fly before it, and seek protection in the deepest and most wooded cañons. Near Julesberg I once saw the snow dotted with the bodies of a great number of snow birds frozen to death in a storm a few days before. Men suffer more than other animals."—"The icy wind cuts like a knife, no clothing seems to keep it from the person, and penetrating to every part, it drags out every particle of vital heat, leaving but a stiffened corpse of him who is so unfortunate as to be exposed to it." *

Thus in the winter of 1865 and '66, Colonel Dodge informs us, a considerable command of U.S.A. troops was caught on the Cimarron River in one of these storms, "and barely escaped total destruction. An officer who was with it described their sufferings as most fearful. Many men were more or less frosted, and about 600 animals frozen or starved to death" †—"still more recently at least 100 buffalo hunters perished from cold within 100 miles of the Arkansas River in two years"—"and during the winter of 1872—3 over 200 men lost hands or feet or parts of them" and "at least 70 capital amputations were performed by the post surgeon at Port Dodge" on persons who had limbs frozen, "whilst a much greater number were sent East for treatment." §

It is, however, fortunate for the habitability of these plains, that storms of such excessive severity are comparatively rare, and when they do occur, are seldom of long duration; and of course with the advance of

* *The Hunting Grounds of the Great West*, by Col. Rich. I. Dodge, U.S.A., 1877, p. 39. † *Ibid.* p. 41. § *Ibid.* p. 39.

the settlements into the wilderness, it is more easy to run to shelter than formerly, when there were thousands of square miles without a house or even a bush of any kind, to be seen upon them.

Now, as regards the cause of blizzards, it seems hard to come to any other conclusion than that the sudden onset of the intense cold, which characterizes these terrible visitations, is due to atmospheric disturbances taking place in the great celestial altitudes, far beyond the reach of human observation: which cause a strata of icy wind, there prevailing, to descend upon the earth. This seems to afford the only reasonable way of accounting for their sudden occurrence perhaps during the course of a mild day, after a spell of fine and apparently settled weather.

That currents of air blowing in different directions at the same time do exist, we can often see for ourselves, by observing the movements of the clouds, which may be seen passing in different directions, at different altitudes, thereby placing this fact beyond a doubt. Also, the approach of a storm is often indicated by the clouds flying rapidly overhead, while a calm still prevails at the earth's surface: thus proving that a gale, as yet unfelt on earth, is blowing in the regions of space above. Then, we know that as we ascend to great elevations we always encounter progressively increasing cold, as we mount up. This is a fact so well established, that it is merely necessary to point it out—the occurrence of snow-capped mountain peaks under the rays of a tropical sun, however, affords conclusive proof of it; and observations show that at an altitude of about 16,000

feet above the level of the sea, we reach the limits of a region where eternal snow perpetually exists, in the hottest parts of the world.

It is therefore evident that if a strata of wind is suddenly displaced by some disturbing cause, and made to descend from some great altitude upon the earth's terrestial surface, it is certain to reach us in an intensely cold condition; and in its transit it will be sure to precipitate the aqueous vapour of the lower currents of air, either in the form of a very cold rain or more probably as snow—and this is exactly what occurs, the sudden drop in the temperature being generally immediately followed by blinding showers of drifting snow.

As we have already remarked, American meteorological observations show that the true blizzard rarely visits the Atlantic seaboard in its severest forms; nevertheless, as we shall proceed to show, these visitations occasionally occur, and we shall close this branch of our subject by a short description of one of the most terrible of these storms that has ever been recorded, which burst upon New York, and other eastern seaports, in the spring of 1888. The previous winter had been a stormy one, and the north western states had been visited by a blizzard of unusual intensity during the month of January, concerning which we are told—"appalling accounts of suffering and loss of life, consequent upon the recent blizzard, continue to come in."*—"The total number of victims is now expected to reach 200—and in addition to those frozen to death, large numbers had limbs badly frozen, while

* *Times* of January 18, 1888.

many lost their way and perished, only a short distance from places of refuge." *

The following March witnessed the advent of the greatest blizzard that had ever visited the eastern states within the memory of man. The *Times* of March 17 says——

"For the first time in the present generation a north western blizzard has attacked the Atlantic Coast of the United States, and has been raging for the past three days. Friday and Saturday (March 9 and 10) the sky was clear and the air balmy, and Sunday came with a S.W. wind and a warm rain, and the thermometer at 60°. During Sunday night the scene underwent a change, as remarkable as unexpected: the wind changing to the N.W. After midnight the cold grew intense and by morning was accompanied by a blizzard against which nothing could make head. All telegraph wires broken down, rendered isolation perfect, from New York, Philadelphia, Baltimore, and Washington; each city being as much cut off from communication with the world as if it had been in the centre of the ocean. Enormous snow drifts filled up railway cuttings; scores of trains, bearing thousands of passengers, were blockaded in snow drifts, sometimes 20 feet deep.—On Monday, the 12th, the weather moderated, but at nightfall came another piercing N.W. wind, freezing everything fast, and holding the snow drifts with an icy hand, that nothing could unloose.—Tuesday, the 13th, dawned with almost all movement paralyzed, worse than before. The wind howled, and the snow drifted throughout Tuesday until night, during which the storm blew itself out." †

Such is a brief outline of this terrible tempest, and for many days the papers were literally filled with

* *Times* of January 19, 1888.
† *Times* of March 17, 1888.

details of death, destruction, and ruin, that had been wrought by the deadly cold of this pitiless gale. Its fiercest efforts were in and around New York, where the *Times* states that over 200 persons perished. The letter of this paper's Philadelphia correspondent recounts many additional particulars, and mentions among others things that

"as the workmen dig out snow pits, corpses are found of persons frozen to death—standing in the streets, where the snow overcame them. 5000 men and 1000 horses and carts have worked throughout the entire night, clearing a passage through Broadway, where snow lay 6 to 10 feet deep. Among the troubles of New York is the inability to reach the cemeteries for funerals; and 500 corpses have accumulated unburied throughout the city. Nearly 200 shipwrecks are already reported." *

So remarkable and extensive was the destruction wrought by this great storm, that the newspapers almost without exception devoted leading articles to the event, which is fortunately almost without a parallel in the history of modern times—and the *Times* commenting upon it says in a leading article that,

"The blizzard which sweeps the North Westerly plains of North America, has during the memory of the present generation, been a respecter of boundaries, but on the night of March 11th the wild west flung itself for two days upon the eastern seaboard of the United States. The extent of the disaster is little realized in Europe. There is an indefinite, and still expanding total of deaths by freezing, shipwreck, and railway accident. One estimate places the (monetary) losses at £4,000,000, of which nearly £1,500,000 are assigned to New York. In its very streets, a few yards

* *Times* of March 18, 1888—Extract Letter of Philadelphia Correspondent.

from warmth and comfort, pedestrians were overwhelmed by the blinding storm, and their frozen bodies, still in a standing position, have hardly yet ceased to be dug out from the closely packed snowdrifts."—"The great blizzard has had its lessons. If we regard man as claiming supremacy over the forces of Nature, such a storm teaches us how far man is from subjecting the tempest, or even predicting its onset; and how the mighty organism which he has pieced together, can be paralyzed in a few hours, and left dependent for life upon the forbearance of the conqueror.—The storm that has visited New York is the worst which has visited it within human memory; yet in a fortnight the great blizzard will be forgotten, and man will be absorbed, as blindly as ever, in the struggle for riches or subsistence." *

Yes! in the fierce race for wealth, and amid the continual whirl and turmoil of life in a great city, these things are soon suffered to pass out of mind. The dead are buried, and their memory perishes; the lesson which the great event has taught is as completely forgotten as were the plagues of Egypt in days of old the moment they ceased to trouble—and yet had the icy gale continued but a little longer, it is not too much to say that none of the plagues of Egypt could have borne comparison with the blizzard in its disastrous consequences. For as the same article which we have quoted from above, points out:—

"Stop the circulation in a human body, and life is snuffed out at once; but the circulatory system of a city admits of a longer pause; but it is only a question of days; and if a second storm had supervened upon the first, the pulse of some huge community might have ceased to beat for ever." †

* Extracts *Times*, Leading Article, in paper of March 19, 1888.
† *Ibid.*

There can be no doubt of it! Some of the drifts were described by eye-witnesses as mounting up, at certain points, as high as the first floor windows of the houses, and New York had already begun to suffer from partial famine. * "People were unable to get down town, or in from the suburbs."—"Many banks were unable to open their safes, because the officers could not get to the banking houses."—And, "the Stock Exchange finding business impracticable, adjourned." † The dead lay unburied, and the living were unable to go out to the shops to buy food—a little more and the words of the *Times* might have been verified, and the pulse of the great city might have been stilled for ever. "The blizzard has made good its claim, with fire, famine and earthquake: as one of the great visitations to which societies of men are liable," § and the sensational novelist could find endless material in its tracks for the exercise of his most exuberant fancy. Happy are we in Britain, that for so far no such storm has been recorded. There can be no doubt that the ocean exercises a powerful influence in such matters—yet at times our storms are bad enough. An English blizzard of minor force did, however, occur on the night of Sunday, December 25, 1886, by which a large portion of the English telegraph system was destroyed. With many parts of England communication was entirely suspended.

"The combination of so heavy a fall of snow with so powerful a gale" (says the *Times*) "was almost without precedent. Few winters pass without some weak point being

* *Times* of March 17, 1888.
† *Times* of March 16, 1888.
§ Extract *Times*, Leading Article, in Paper of March 19, 1888.

displayed, but nothing like the destruction of the night of Sunday, 25 December, has within any recent period been witnessed in England. On that night many London streets were rendered impassable by the wrecked wire, etc."*

The most violent class of cyclones—which are so common in America, and destroy whole towns and villages, levelling the houses, etc., as if the place had sustained a bombardment from heavy artillery—do not, however, very fortunately for us, visit England; it is hard to say what damage and loss of life might ensue, if the track of one of these hurricanes, of the severest type, swept across the city of London—such, for example, as that which on March 27, 1890, passed up the Ohio valley, moved through Kansas, Missouri, Illinois, and Indiana, and attacked the town of Louisville, Kentucky. The destruction of the places along the track of the storm was complete, for at Louisville

"in an instant great stone warehouses, places of amusement, railway stations, private dwellings, were levelled with the ground—and on an area of about half a square mile nothing was left but a mass of débris."—"The tornado passed diagonally through the city from S.W. to N.E. Its path was two miles long and 500 yards wide."†

Several hundreds of people were killed or injured by the falling houses, etc. The hurricane, however, quickly passed over, the clouds dispersed and the moon shone out brightly over a scene which the *Times* states "beggars description."

Another very curious phenomenon, consisting of an atmospheric disturbance of a different kind, is a "dust

* Extract *Times*, Leading Article, in Paper of January 6, 1887.

† Extracts from "Latest Intelligence" column of London *Times* of March 29, 1890.

storm." They are very common in all dry countries, and consist of a minor kind of tornado, unaccompanied by rain, which sweeps before it tremendous clouds of dust and sand; in the most violent of these storms the dust cloud becomes mixed with gravel, which beats against the face, almost like a charge of small shot. Such storms sometimes come up so suddenly, and with such extreme violence, that it is difficult to face the driving clouds of sand, etc. We were once caught in a tremendous whirlwind of sand and dust of this kind, on the road near Damascus, in Syria. The horses were obliged to be frequently halted, and turned with their backs to the wind, and it was only during the lulls in the storm that travelling became possible. South Africa is notorious for this sort of storms, and in our chapter on the Desert Zone we shall relate some curious facts concerning them.

The waltzing columns of sand, which are so frequently seen in the Nubian and other deserts, caused by whirlwinds, or eddies of heated air, are among the most curious of these phenomena, and may frequently be seen from the decks of Nile boats proceeding up the river, beyond the first cataract, and occasionally they sweep across the river itself, and so obstruct the view that steering becomes difficult, or even impossible. These dust columns, though perhaps they may not attain the same magnitude in Lower Egypt as they do in the Nubian desert (where the late Sir Samuel Baker has estimated some that he saw between Korosko and Abu Hammed, as from 1000 to 1500 feet in height), are still frequently seen there rising to a great altitude. On the Karroos in South Africa, we have also been assured by

residents that they often see them quite 1000 feet high. On the Indian plains, and in Australia also, large examples may often be seen; so that this phenomenon is by no means peculiar to the sandy desert.

It is not easy to determine the exact cause of their formation. The traveller may himself be standing at a spot where the sultry air is unruffled by a breeze; and yet he may behold several of these travelling pillars of sand, moving slowly across the plain around him; but if we might venture to hazard an opinion, we should say that they are caused by ascending columns of heated air, which gradually suck in ground currents of the surrounding air to fill the vacuum created there; as this movement progresses its action will tend to increase in intensity until the inrush becomes exceedingly powerful. The gyrating movement, we should judge, would then result from its meeting opposing currents of air which would thus create an eddy, exactly as a sharp curve, or other obstruction, in a rapidly flowing river, will produce a backwater with a species of miniature whirlpool. After a certain time, when the forces which created these dust pillars have spent their strength, their action becomes exhausted, and the column of sand or dust collapses, and falls in heavy showers to the ground. This, in fact, is exactly what may be seen to occur, for the collapse of these dust columns often takes place quite suddenly, and without any apparent cause.

The fall of the sand from these whirlwinds in former days was much dreaded by travellers who encountered them in the great deserts, where they occur in their most serious form, for they were under the impression

that anyone underneath them would certainly be buried alive. The exaggerated tales respecting such things circulated by the Arabs, even to the present day, sound not a little alarming; and there is the well-known instance mentioned by Herodotus, * when the army of the Persian monarch Cambyses, consisting of 50,000 men, was, in the sixth century before Christ, buried in the drifting sands during its march across the Libyan Desert. † But we shall refer to this event more particularly in our next chapter.

For ourselves, however, we are inclined to disbelieve altogether the story of their destruction by being buried in sand, as we think it much more probable that an army of this size perished through losing their way, either through the want of proper guides or the treachery of those employed, which would of course entail the loss of the whole force, by thirst; the bodies of the dead would most probably then be gradually covered by the drifting sands, which would give them the appearance of having perished by being thus buried, during life, in a sandstorm. Our experience of desert marches teaches us that any little obstacle whatsoever will collect the sand drift, which will form a dune around it until the whole is completely hidden from view. The buried tombs and temples of ancient Egypt are good examples of this, and the curious reader will find many other details relative to such matters, which we trust may prove both interesting and instructive, in our section on "The Desert Zone."

* History by Herodotus, *Thalia*, Book iii, Caput. 26—Translated by Henry Cary, M.A., 1891, p. 152.

† The data of this catastrophe is generally set down as occurring in the year 524 B.C.

While we see grave reason to doubt that a force of living men could ever be actually overwhelmed and buried alive by a sandstorm (seeing that they can shift their position as the sand collects, and so can thus always prevent the unpleasant alternative of allowing it to smother them),—we do not desire in the slightest degree to minimize the exceedingly unpleasant and even serious consequences, which a great dust storm may entail. Such a storm may occur on any dry plain,—for instance at Johannesberg, the great gold-mining city in the Transvaal, where dust storms are very common, the dust was always so great that we felt inclined to name the town "The City of Dust"—residents have informed us that they have often known (in the earlier days of the city, when the streets were worse than they are now) immense Cape waggons drawn by 18 oxen, to be entirely hidden by dust from the view of persons standing on the sidewalk, while passing along the middle of the street.

This we can quite believe, for during one dust storm which occurred while we were there, everything was hidden from sight at a very short distance, and the dust clouds entirely filled the streets, up to and above the roofs of the houses. The thing lasted only two or three hours, however, and was a nuisance rather than a danger.

But sometimes matters prove more serious, especially when the storm lasts for a considerable period. A party, for instance, crossing the Colorado Desert in America, thus relate their experiences:—

"We were overtaken by one of those dreadful sand storms, which prevail in this desert. The day was intensely hot, and the most oppressive silence reigned around. Suddenly

a dark, dense cloud arose in the West, and moved towards us with incredible rapidity. Great masses of heavy sand were lifted like so many feathers, and the plains formerly occupied by large hillocks, containing thousand of tons of sand, were swept even as if by magic. None of us could stand against the force and weight of the storm." *

Even assuming that the quantity of sand thus removed is overestimated, this shows with what fierceness these storms rage when a really bad one occurs. Another instance we may quote is the case of a French column in Algeria, commanded by the Dukes D'Aumale and Montpensier, which on the 7th of March, 1844, was overtaken in the Algerine Sahara, by the Simoom; in this case the storm "prolonged its furious assaults during 14 hours." Yet on the following day Monsieur Fournel, a mining engineer, who accompanied the force, found that the storm had merely affected a narrow zone parallel to the Aurés range, and that at the mountain base the tranquillity of the atmosphere had been undisturbed.†

This shows how partial such tornadoes often are in their area. At times they assume the ascending form, which we have described as creating vast pillars of eddying sand, or dust, in the desert, which often mount up to an enormous height; thus showing that the direction of the propelling force is upwards; and in their ascending rush through surrounding strata of still air they assume a gyrating motion, exactly as the water in a large bath, let off by withdrawing the plug, forms a vortex. In this case, as we know,

* *Life among the Apaches*, by John C. Cremony (Interpreter to the U.S. Boundary Commission), 1868, pp. 125—6.

† *The Desert World*, by Arthur Mangin, translated from the French, 1869, p. 138.

the rapidity of the whirl, and the strength of the downward rush, produce a loud sucking noise, caused by the air forcing its way down, through the middle of the water, which then forms, as we can easily see, a species of hollow cylinder of fluid.

We should therefore be inclined to hold, that in all probability these moving and gyrating columns of dust are, in the same way, not hollow, but motionless, and perhaps also free from dust, at their centres; while the dust particles revolve with enormous velocity around this still centre. We have no actual proof at hand to show that this is so, but such is our personal belief—because, in the case of rotatory cyclones affecting a large area, this still portion is almost invariably present at their centres, and may have a diameter of several miles.

Then, as to the next, or horizontal form of these air-jets, those are merely another modification of the above phenomenon; only the axis of the propelling force is approximately parallel to the terrestrial surface; but in this case, as we believe, the whirl is to a great extent neutralized by the attraction and obstruction of the immovable surface of the solid earth. Nevertheless, that it exists in a modified form is clear from the violent way in which masses of sand, etc., are scooped up and whirled aloft. We remember on one occasion witnessing a storm of this kind from the deck of a vessel in the Red Sea, near its north western end. An enormous cloud appeared sweeping along the coast in a southerly direction, evidently consisting of dust and sand, for the sky was at the time elsewhere cloudless, and the atmosphere at sea a steady pleasant breeze; whereas this dust storm

moved with great velocity along the desert. The dust clouds in spots rose to a great altitude, and as they progressed occasional blasts of wind shot out laterally across the water, showing how fiercely the storm was then blowing on shore. This lasted perhaps an hour, and then all was again still; the ruddy coloured chain of desert hills once more stood out in all their barren desolation; their outlines in the now pellucid atmosphere showing as clearly as if they were modelled in adamant, so that their minutest details were discernible.

In the same way in the wooded tracts of forest, found near the courses of rivers in the great plains region of America, the track of some of these rushes of air may be traced, where they have passed through the wood, like the blast from the mouth of a cannon. In their course (which may vary from 100, to perhaps 500 or more yards in width), the whole forest is levelled to the ground; not one tree, in many cases, having been left standing where the vortex of the storm has passed. The narrow front along which such hurricanes frequently move, is thus seen in the clearest way; and the traveller through these wild regions (as they were when we visited them) had frequent and ample opportunity of noting their exact effects. At other times circling eddies of wind will scoop a space, right out of the heart of a wood, destroying *everything* within its vortex, but leaving the trees all round it untouched; it is therefore clear that the whirlwind has been of the ascending form: and so everything outside of its rotatory whirl escapes. The influence of the eddy in fact probably extends only a very short way beyond its edge. We do not

often have such things in England; nevertheless, the following is an instance of a minor whirlwind which did occur there. It took place on the banks of the Thames, opposite Taplow Court, Maidenhead, on July 4, 1890, when "a whirlwind suddenly carried several cocks of hay from a field, to a great height. Some of the hay was carried across the river, and dropped at a considerable distance on the further bank. A large quantity of water was also lifted from the Thames, to a height of over 12 feet." *

These phenomena therefore, though perhaps more common in the Desert Zone than elsewhere, may, it is clear, occur almost anywhere, and at any moment, provided the condition of the atmosphere is in that peculiar state of disturbance which produces them.

We must close this section with a short review of the general conditions which the terrestrial atmosphere bears towards the earth; and as it seems to us we must regard the latter almost as a fish floating in the centre of an aerial ocean, which envelops it with a gaseous fluid, much as the waters of the sea enclose a fish; while we, the dwellers upon earth, are constantly living (as do animalculæ upon the bed of the terrestrial sea) at the bottom of a vast atmospheric ocean of enormous depth: how deep it is not known, but the most generally accepted opinion, at present, is that its depth is at least 120 miles—and the probabilities are that it is a great deal more; it is suggested that, "in an extremely attenuated form, it may even reach 200 miles;" † future investigations, we are inclined to

* *Morning Post* of Saturday July 5, 1890.
† *Encyclop. Brit.*, 9th edit., Vol. iii, p. 35.

think, will, however, increase this estimate: it is not easy to place a limit to the possible tenuity of an elastic gas.

Be that as it may, however, this atmospheric ocean has its tides, its currents, and its circulation, exactly as has its terrestrial counterpart; and though of course the specific gravities of the two elements widely differ, air has still its measurable weight, just as water has. Its pressure upon the surface of the sea being, as we all know in these comparatively enlightened days, something like 15 pounds to the square inch: or, to speak more accurately, its weight is equal to 14.7304 pounds on each square inch.

This is not so very much less than that of the steam in the old low pressure boilers of our engines; if, however, we desire to understand what that means, we find a good illustration in the fact that the body of a man of ordinary size sustains a pressure of about fourteen tons.* In consequence, however, of this pressure being equally exerted in every direction, both within and without the body, we sustain it unconsciously, though the addition even of a single pound, placed say upon the hand, is sensibly felt. Such, however, is the Law of Nature: equal forces, exerted in opposite directions, neutralize each other.

The winds of course represent the currents of the atmospheric sea, this is easily understood; but as regards its tides the matter is not so clear. Nevertheless the subject is one of vast importance. They ebb and flow according to the season, exactly as do the marine tides: high tide being in this case repre-

* *Encycl. Brit.*, 9th edit., Vol. iii, p. 28.

sented by regions of high pressure, and low tides by areas of opposite conditions.—There are two of these great regions of high atmospheric pressure, one to the north, and the other to the south of the equator, both of which extend precisely as in the case of our Climatic Zones, as broad belts completely round the earth. The highest of these tides is usually located during winter in the centre of a great continent —notably in that of Central Asia; and in the summer time they shift to the surface of the ocean, which then becomes the area where the maximum atmospheric pressure prevails, especially in the Southern hemispheres, (where the location is much less subject to change than in the Northern, because of the enormously greater predominance of ocean there). The most common location for the area of maximum pressure at this time of year may be generally roughly said to be about latitude 30. * This, however, is a general indication of an approximate nature only.

The weight of the atmosphere is generally measured by the barometer, which rises with increasing pressure; whereas, as a weather-glass, the barometer only inferentially indicates what the weather is likely to be. Dry air is heavier than damp air: therefore when the barometer goes up, we infer that it will be fine weather, because the air is comparatively dry. Sudden ups and downs in the glass, however, are probably caused by the transit of a great atmospheric billow in the zenith; as this passes above us, the increased weight of the air causes the mercury to rise, and when

* The British Admiralty has published a series of charts, which show the mean pressure of the atmosphere over the Ocean, at the different seasons.

a "depression" is passing overhead (like the trough of the sea between the waves), it falls in a corresponding degree.

Great cyclones, in point of fact, are simply gigantic eddies of the atmospheric ocean, having a diameter it may be of several hundreds of miles, which circle round just like the eddies of a river, as they move along the stream. These immense aerial whirlpools will of course draw the clouds towards them, while the descending eddies of cold air, will cause them to be precipitated in rain; but it does not necessarily follow that these extensive cyclonic areas, are accompanied by wind storms. When the wind circles round these vast arenas, it is apt to do so more slowly than in the smaller cyclones, where the velocity of the whirl is much greater: a small but rapid whirlwind will therefore usually create a deep but transient depression, which as it passes overhead, is immediately indicated on earth by a sudden and correspondingly large fall in the barometer, an instrument which, as we have said, is merely a machine for measuring the height, or in other words, the weight, of the atmosphere, as indeed its name denotes. *

A heavy fall in the glass therefore warns us that one of these deep and probably violent cyclonic depressions is approaching; the greater and more sudden that fall is, the more serious the disturbance of the weather is likely to be: and yet it may after all pass by, and nothing may happen; this is because these storms, in their furious and erratic course, are often deflected from their original direction; and so, after

* The word "*Barometer*" being formed of two Greek words, "βαρος," weight, and "μετρον," a measure—*i.e.* "a measure of weight."

merely threatening a locality with their invasion, they are turned aside, and go off elsewhere. In this case, if we watch the newspapers, we shall probably hear of its effects at the points which had to undergo the brunt of the attack, that we have been fortunate enough to escape. At other times it may be that we may encounter a short but sharp stormy interval: this is the same thing varied only by the fact that, instead of escaping in toto, we have in this case come in for "the tail of the storm," and so have experienced the partial effects of the inrush of air from the edge towards the centre of the disturbance.

Having now briefly sketched some of the most prominent features connected with the barometer in its relation to atmospheric disturbances, we shall bring this chapter to a close, and with it the first division of our work; and next proceed to describe, in their order of succession, our six great Climatic Zones.

CHAPTER V.

THE GREAT FOREST REGION OF THE EQUATORIAL ZONE.

Its Position, Extent, and Characteristics. Its Perpetual Verdure. Rapid Transition from Day to Night. Beauty of the Equatorial Dawn. Malarious Districts. Precautions for Preserving Health. Healthy Stations. Their Mean Temperature. The Question of European Acclimatization. Anecdote of the "Deadly Climate" of Africa. The Liquor Traffic in Africa. The White Man's Example to the Negro. The Inhabitants of the Equatorial Zone. Their Antiquity. The Struggle for Existence against Exuberant Vegetation. Equatorial Africa. Equatorial America. The Malay Archipelago. Ceylon and Southern India. Evidences of Ancient Civilization. Disappearance of Ancient Races. Abandonment of the Great Cities of Antiquity. Probably due to Pestilence. Drought, Famine, and Pestilence at Ceara. "Dry Districts" in the Equatorial Zone, how Accounted for. The Great Primeval Forest Region. Forests of the Upper Congo. Stanley's Great Forest March. Twilight Caused by the Density of Equatorial Forests. Open Plains and Bush Country in the Equatorial Zone. How accounted for. The Great Amazonian Forest. Difficulties of Travelling in it. "Blazing" a Path through the Forest. Profusion of Plant Life in Equatorial Forests. Their Enormous Unexplored Area and Vegetable Treasures. The Great Forests of the Gaboon. Gigantic Trees and Lovely Forest Scenes. Apparent Dearth of Flowers. The Equatorial Forest as *A* Forest. Its Several Distinct Tiers of Arborescent Growth. Gigantic Trees of the First and Highest Tier. Shade-Loving Trees or the Second Tier of Forest Growths. Dwarf Palms and Tree Ferns, or the Third Tier. Herbaceous Plants. Glories of the Tree Ferns. Schweinfurth's "Gallery Forests." Deadly Nature of the Climate in Heavy Forests Generally Exaggerated. Experience of the Emin Pasha Relief Expedition. Europeans struck down by Fever on Leaving the Forest and Entering the Open Country. Explanation of this Remarkable Fact. Natural Curiosities of the Equatorial Forest. Buttressed Trunks. Height of Some Great Trees, and Consequent Difficulties in Determining their Species. Imperfect State of Knowledge Respecting "Jungle Trees." Surface Roots. Air Roots. Great Indian Banyan Trees. Description of a Tree of this Species in Milton's "Paradise Lost." African Banyan Tree. The Sacred Bo-Tree of India. Supposed Origin of this Superstition. Seedlings Growing Upon and Destroying Buildings. Air Roots Running Down Walls, etc. Vegetation Effacing the Works of Man. Tropical Foliage. Leaves of Seedlings Larger than those of Mature Trees. Probable Explanation of this Fact. Palm

Leaves. Palm Trees in a Gale. Areca Palms. Gigantic Palm Leaves. Height of Lofty Palms. Bamboos. The Growth of Bamboos. Bamboos seen at Night. The Great Repose of Nature. Tropical Creepers. Rattans. Great Thickets in Tropical Forests. Their Gloomy and Impassable Character. Lianas. Their Occasional Gigantic Size and Magnificent Flowers. Orchids. Vanilla. Foliage Plants. Shade-Loving Plants. Brilliant Colourings of Young Leaves and Shoots. Necessity for a Good Glass in Examining Jungle Trees. Jungle Paths. Tropical Fruits. Bananas as an Article of Food. Their Varieties. Banana Leaves. Leaf of the Musa Ensete. The Bread Fruit Tree. Mangoes. The Coolness of Tropical Fruits. Power of Vegetables of Adjusting Their Own Temperature. Cause of the Coolness of Fruits. Animal Heat and Vegetable Temperature Contrasted. The Commercial Products of the Equatorial Zone. Medical Treasures. Cinchona Trees. The Introduction of Cinchona into India. Attempts by Peruvian Government to Prevent the Export of Seeds. The Value of Quinine to Explorers. Indian and Ceylon Cinchona Plantations. The Discovery of Quinine. Noble Conduct of Two Young French Chemists. Paltry Reward Granted for Their Services. Illustrious Deeds of Men of War and of Peace Contrasted.

IF we take the Equator as a central line dividing our globe into two hemispheres we have two belts of country extending on either side of it, as far as Lat. 15° N., and Lat. 15° S., which together occupy a section of the earth's surface, 1800 geographical miles in width,* forming the great Equatorial Forest Zone, and extending through the calm belt of low atmospheric pressures where rains fall throughout the year, into the region of the double rainy seasons, where they fall for at least half the year.

The wide area included within the above limits, gives us on the whole perhaps a more correct idea of these great forest regions, than a subdivision into a

* This coincides with Meyen's division of the range of temperature into zones. See his *Outlines of the Geography of Plants*, 1854, p. 161. But his divisions are generally too numerous and complicated to receive general acceptance—though we regard his work as deserving of a high place in the science of geographical botany, and we follow his range of equatorial climates, in preference to some of the more modern commentators.

smaller, and more strictly speaking equatorial belt, lying exclusively within the zone of constant rains; because large areas of the heavy forest generally extend far beyond these limits, though its most characteristic features are of course more strongly marked towards its centre, than on its outer edges, where on account of the occurrence of dry periods, we begin to enter the region of deciduous trees. It is for these reasons that we have adopted Meyen's limits for the equatorial regions. It will, however, readily be understood that no hard and fast line is drawn in Nature, and that in all cases one class of vegetation is only gradually supplanted by another.

The whole of this great region may, however, generally speaking, be described as a hot, damp climate, with little change of season throughout the year. The successions of summer and winter are alike unknown—the climate on the whole most closely resembling that of a perpetual spring, a wonderful equability of temperature constituting its most remarkable feature. It is never cool; but, on the other hand, the extreme heats which prevail further to the northward and southward, are never felt here; from the superabundance of vapour always present in the air, the atmosphere is generally to a certain extent misty, and thus the fiercer heats of the rays of the vertical sun are less strongly felt: so much so, that the newcomer is often surprised to find himself so little oppressed by the heat; it is rather the long unbroken continuity of high temperatures than the great heat, which proves trying to the European resident.

In these regions flowers bloom throughout the entire year; fruits of various kinds follow each other in con-

tinual succession; and the spectacle of a tree covered with flowers, while the ripening fruits hang from its branches, is common. The trees as a rule are always green, very few being deciduous, indeed a tree without leaves is generally a dead one: except perhaps the "*Bombaceæ*" or Wild Cotton Trees *—splendid trees with thorny trunks, which in spring appear bare of leaves, and covered with a magnificent display of large crimson flowers. There are some few other sorts of the same habit, but these exceptions to the general rule are comparatively rare.

The prevailing tint of the landscape is a dark and rather sombre green, very striking at first to the newcomer—conveying to the mind an idea of boundless fertility, but apt to become somewhat monotonous, as the eye gets accustomed to it; and as a rule the land in its natural condition, even to the top of the hills, is covered with a dense mass of verdure.

The rapid growth of vegetation in these regions is something that must be seen to be fully realized, as it would otherwise appear altogether incredible to residents in temperate climates: "beneath a vertical sun, new leaves and buds unfold almost before the eye, and fresh shoots may often be observed to have grown many inches since the preceding day." †

Another characteristic which is always very striking to strangers, is the rapid succession of day and night. The length of the days in these latitudes is of course pretty well the same throughout the year; but it is

* A good example is the Red Cotton Tree or *Bombax Melibaricum* of Ceylon and British India. The *bark* of these trees is generally covered with spines.

† *Tropical Nature*, by Alfred R. Wallace, 1878, p. 22.

the sudden transition from light to darkness which is so remarkable; and though somewhat exaggerated descriptions of this phenomenon are prevalent, it is nevertheless exceedingly impressive. Mr. Wallace in his "Tropical Nature" has endeavoured to place an accurate picture of it before his readers, and says that:

"at the end of about 25 minutes from sunset, complete darkness of night is almost reached. In the morning the changes are perhaps even more striking. Up to 5.15 a.m. the darkness is complete, about 5.30 a.m. the first glimmer of light becomes perceptible. It slowly becomes lighter, and then increases so rapidly that about 5.45 it seems full daylight. For the next 15 minutes this changes very little, when suddenly the sun's rim appears above the horizon."—"The first hour of the morning," (Mr. Wallace proceeds to remark), "in the equatorial regions, possesses a charm and a beauty that can never be forgotten, and its temperature is the most delicious conceivable." *

This exceeding loveliness of the early morning, in tropical countries, has attracted the universal attention of travellers; and those who value their health will do well to be up, so as to take advantage of it: provided they are not actually passing through malarious districts where ample experience has shown that it is dangerous to be out before the sun is well up. †

Usually, however, when travellers are on the move, a general reveille is sounded a good hour before sunrise, so that the march may commence with the

* *Tropical Nature*, p. 22.

† Europeans should make it a point to take a large cup of strong coffee, and something to eat, before venturing out. In malarious districts 3 or 4 grains of Quinine should be taken as an additional precaution—and they should always sleep under mosquito curtains. Those who lie in bed till the sun gets powerful soon lose their health, as it is too hot by 9 a.m. to take exercise with comfort.

dawn. Almost all the native inhabitants of these countries are up at about this hour—with the sun, in fact. At that hour, Nature seems, with one consent, to awaken from its slumbers, and as the first rosy tints of the morning begin to redden the Eastern horizon, the silence of the night is broken in upon by the calls of birds, the busy hum of insect life, and other tokens which indicate that the advent of the great luminary of the day is the accepted signal bidding them go forth to pursue their daily round of active existence.

In these damp equatorial climates the morning air is generally at this time heavy with mist: and white, smoke-like wreaths of vapour appear drawn like a bridal veil across the face of Nature, the lofty heads of palms and other trees seeming to rise above it, as if starting from the surface of a sea of vapour. But these fogs are quickly dispersed as the sun, arising in fiery glory, bathes the landscape in a flood of light, causing every dewdrop to sparkle like a diamond upon the dripping foliage. The air, too, is often filled with a balsamic fragrance exhaled by aromatic shrubs and grasses, or with the scent of flowers borne aloft on some of the numerous trailing creepers, which entwine themselves like cordage amongst the trees.

But unfortunately, beneath an exterior often exquisitely beautiful there is apt to lurk an element that goes far to neutralize many of its charms; for these places, especially when situated upon the coast line of countries within the equatorial zone, are frequently notoriously unhealthy; for instance, it is only necessary to mention the British and other settlements on the West Coast of Africa, which may most of them be described as

deadly to Europeans. This extreme unhealthiness is no doubt in a great part due to the vicinity of a low-lying, swampy fringe of forest country; which extends pretty well everywhere along that coast. Here, in certain situations (during the evenings especially), the fragrant atmosphere already described is apt to give place to one in which a sickly odour of decaying vegetable matter is often plainly perceivable, and which is at times so strong as to be quite perceptible on board vessels some miles from the coast. * It is one of the wise and beneficent provisions of Nature, which always associates evil odours with that which is hurtful, and fragrant odours with health and things beautiful.

The balsamic freshness and fragrance of the early morning in these equatorial climates is, therefore, when met with, more or less an indication of a salubrious district. On the other hand, this instinctive loathing of what is bad for us is a remarkable fact in our organization.

In like manner, after the exhausting, stove-house-like temperature of the day, the close of the evenings prove brief but delightful periods of enjoyment—but hardly has darkness closed in before it is followed by a copious fall of dew, so heavy that clothing becomes wet through in a short time. The traveller who values his health can never be too cautious in shielding himself from its baneful effects; if suitable houses with proper verandahs attached are not at hand, a good tent is a positive necessity almost everywhere within the equatorial zone. It is mere suicidal folly for the European traveller to expose himself, without proper shelter, to the night-dews in these damp regions.

* *The Influence of Tropical Climates in Producing Disease*, by Sir James R. Martin, 1861, p. 36 (Quoted from Works of Dr. Daniell).

Except at great altitudes such climates are always found more or less prejudicial to the health of European residents, even while taking every precaution. Nevertheless some few exceptionally healthy stations situated upon the coast line, near the equator, may be enumerated; as for instance Para, on the mouth of the Amazon,* and the Dutch settlement at Batavia in Java; and especially our own important naval station at Singapore, which is reported to be one of the healthiest places in he tropics, though situated only about 80 miles north of the line:† this is mainly owing to its situation on a low but healthy island, where there is almost always a light but pleasant breeze blowing, while the nights especially are very cool and refreshing, and enable people to sleep without difficulty.

Still, even though no regular endemic fever prevails, "Europeans cannot escape the debilitating influence of a hot, damp, winterless climate; there are therefore very few rosy cheeks in Singapore. Curiously enough the neighbouring territory of Johore on the mainland, is very unhealthy; and still more deadly is the adjacent island of Sumatra, where the Dutch troops die like sheep."§

In no part of the world, perhaps, is the aspect of a place as regards the prevailing winds so important as in these equatorial countries, where the still, steamy, moisture-laden atmosphere maintains the temperature, day and night, throughout the year, almost constantly at a fixed point. At Batavia, for instance, one of

* We regret to say that recent accounts show that yellow fever seems gradually to be becoming endemic at this previously healthy station: probably on account of its insanitary and dirty condition.

† *Encyclop. Brit.*, 9th Edit., Vol. xxii, p. 93.

§ *Seas and Skies in Many Latitudes*, by the Hon. R. Abercromby, 1888, p. 303.

the good stations just mentioned, the average daily range of the thermometer does not exceed more than about 11^0 F.—say from about 79^0 to 90^0 as a permanent temperature. There can be no doubt that it is this unbroken continuity of these high temperatures, especially by night, which proves so debilitating to the European resident, and predisposes to enlargements of the visceral organs, so frequently observed amongst them.

The exceedingly still and sultry atmosphere is, however, frequently refreshed and broken in upon by rainstorms, which are often accompanied by thunder and fierce gusts of wind; such storms have a great and immediate effect in cooling the air; and while they last, the gusts are often quite cold and chilly. The sudden way in which these storms sometimes come up has been described in our chapter on Climates and Temperatures. The dense blackness of the clouds, and angry look of the sky, at such times, is often quite a thing to be seen, and when the storm at length bursts the effect is sometimes grand in the extreme: the constant roll of thunder; the furious gusts of wind; the tremendous downpour of rain, as if it proceeded from the strainer of a shower bath; all combine to form a scene which can never be forgotten.

Nevertheless, the great cyclones very rarely affect the Equatorial Zone of constant rains and calms—great hurricanes, cyclones, or typhoons (or whatever other name they may be called by) seldom coming down nearer than within 5 or 6 degrees of the equator *—

* See, *The Principal Winds of the Globe, Rains, Ice-Limits, Fogs, Rollers, and Revolving Storms*, by Captain Robert Jackson, R.N., 1890, p. 26 (British Naval Pamphlet).

that is to say, they rarely overstep what we have ventured to assign as the approximate limits of the zone of double rainy seasons, on their equatorial boundaries.

Equatorial storms, therefore, such as we are now referring to, are generally of but brief and ephemeral character. They are grand and imposing while they last; and no less so in the rapid manner in which they generally pass away; the perfect stillness that succeeds one of these passing storms always being most impressive, as if the word of Divine command "Peace Be still!" had been sent forth. In the region of the Double Rainy Seasons, say between the parallels of 5 to 15 degrees of latitude, or thereabouts these storms, however, increase in violence, and last longer than they do in the calm belt, where constant rains prevail.

What is meant by the term "constant rains" is that very little difference exists between what are considered the wet and dry parts of the year; the days being always liable to be varied with intervals of rain and sunshine; only at the time of the transit of the sun in the zenith, in spring and autumn, the rains that follow are generally heavier for the time being than at other times. Thus at Batavia (Lat. 6° 8′ 0″ N., Long. 106° 48′ 7″ E.*) this is exactly the climate that prevails, throughout the year, "little difference existing between the wet and dry seasons, but generally the dry season which lasts from July to December, is varied with showers, and the wet, from January to June, with sunny days." †

At places on the other side of the equator, these

* See Norries' *Navigation*, 21st edit., 1877, "Tables of Geographical Positions," and that of "The Batavia Observatory."

† *Tropical Nature*, by Alfred R. Wallace, 1878, p. 26.

seasons are reversed, the most rain falling from January to June and the least from July to December, while the temperature is maintained pretty constant all the time, say from 86 to 88 degrees Fahr. in the shade daily, with occasional increases of heat up to 90° F.

The question as to how far Europeans may become acclimatized by long residence in these climates, is one which has always been keenly debated, but it would be too long to cite the opinions of the various authorities which have been consulted upon this important point; it must therefore suffice to briefly state that although Europeans may reside for years at a few exceptionally favourable stations where the nights are comparatively cool, and where no endemic form of malarial fever is prevalent, without feeling the worse for it; yet *the European never becomes acclimatized;* and the comparative immunity which experienced residents seem to acquire, is due rather to the adoption of certain necessary precautions, taken at last almost unconsciously to themselves, as part of their daily habits, than to any immunity conferred by acclimatization.

The newcomer on the other hand, brings out with him a store of robust health from the temperate zone, which for a time will often enable him to do things which the old stager would never think of doing; until at length he is perhaps suddenly cut down by some attack of disease of a malignant type, not necessarily the result of a deadly climate, but rather of imprudence. It is against these preventible casualties that the old resident has learned to protect himself. These considerations, therefore, to a certain extent enable us to discount the confident assertion of some who tell us, "I lived for so many years, at such a

place, and did not feel the worse for it"—and on the other hand we can appreciate at their true value the often highly exaggerated reports which are current as to the deadly climate of certain notoriously unhealthy places. As an illustration of how places sometimes acquire a bad name in this way, we may cite an amusing instance, related by the late Sir Richard Burton, as occurring on the west coast of Africa:—

"I went" (he says) "to the English factory; the head agent was absent, leaving business in the hands of two 'mean whites.' The factory, a dirty disgrace to the name, was in charge of a clerk, whom we saw being rowed about, bareheaded, through the sun, accompanied by a black girl, both as far from sober as might be. The cooper, moony with drink, rose to receive us, and to weigh out the beads I required. Under the excitement he had recourse to the gin bottle, and a total collapse came on before half the work was done."—"Why" (exclaims poor Sir R. Burton in a burst of scornful irony)—"Why should south latitude 6 degrees be so fatal to the Briton?" *

Perhaps we might be pardoned for offering a few remarks at this point upon drink and the drink traffic upon the African coasts. There can be no doubt that the extreme monotony of existence at many of these places, where there is not a single thing to do which can afford healthy recreation to the small knot of Europeans condemned to dwell there, together with the exhaustion produced by the debilitating climate, largely contributes to this pernicious habit of "taking stimulants." Dram drinking, a bad and demoralizing practice everywhere, is peculiarly fatal under the rays

* *Gorilla Land*, by Captain (afterwards Sir) R. F. Burton, Vol. i. p. 145.

of a vertical sun. Moreover rum, and other products of the sugar cane, which are so extensively used in Africa, and the West Indies, are perhaps the very worst and most unwholesome form of spirits, for use in these climates. The gin is mostly of Dutch manufacture and is largely imported by the Portuguese. We may cite an instance in point, recently reported from Delagoa Bay, where we are told, "a ship came in with a cargo of 900 demijohns of Holland gin—here satirically termed 'Missionaries'—this precious stuff being—'*56 over proof strength.*'" *

After being duly "mixed" for use, it seems this consignment was intended for the benefit of the native tribes to the northward of the British South African possessions, where its "missionary" qualities will doubtless be duly appreciated. The native races here, as everywhere, unfortunately seeming to possess a special talent for picking up all the vices of the White man, with but few, or none, of his virtues. Also it is to be feared that many of the "White pioneers of Civilization" are not always altogether favourable specimens of European progress; their language and conduct at times being such as would be deemed entirely out of order at an evangelical meeting in Exeter Hall. Under these circumstances it is not to be wondered at that the efforts of missionary societies are not always as successful as the public at home sometimes seem to suppose. These considerations recall to our memory the pungent remark of an old Guinea Coast Captain, made in our hearing, during a discussion upon these subjects, many years ago. Something happened

* *The Prisoner of Chiolane*—or with the Portuguese in S.E. Africa, by Wallis Mackay, 1891, p. 33.

which caused the Captain to observe that it was "all d—d humbug." His interlocutor, "miffed" at the unceremonious reply wanted to know what he meant by "humbug." "A cargo of Missionaries and Bibles in the cabin, and a cargo of idols, cheap trade muskets, and rum in the hold," *that*, so the Captain said, conveyed a good idea of what he called "humbug."—Leaving the reader to form his own conclusions upon these matters, we pass to the more direct consideration of our subject.

Taking the equatorial zone as a whole, though it is everywhere dotted over with the dwellings of man, probably from periods of immense antiquity, it may be safely affirmed that nowhere, except perhaps in the arctic regions, has the wilderness so firmly and constantly maintained its dominion. In the arctic zone, of course, the habitations of man have been restricted by the barren soil and the rigour of the climate. Here, on the contrary, it is by the exuberance of Nature that he has been overwhelmed, for even assuming that man, such as we find him in these hot countries, was possessed of the physical energy necessary to keep in check the rapid accumulations of vegetable growths, and the innumerable armies of insect life which destroy his crops, a continual struggle for existence is created, in which man, unless confining his efforts to a very small area, or working in numerous communities, would soon be tired out, and all evidence of human works quickly hidden under a thick canopy of perpetual verdure. His permanent settlements within the equatorial zone, are therefore mostly confined to cities and other centres of population, planted on the sea coasts or upon the banks of navigable rivers,

many of which have evidently been selected because special circumstances seemed to favour the efforts of the human settlers, such as the sandy, rocky, or otherwise sterile nature of the soil; or the existence of dry districts which, owing to these and other local causes, sometimes occur within the equatorial zone.

In saying so, it must be understood, however, that we speak in general terms of this great region as a whole; we are quite aware that numerous instances might be mentioned where the forests are cleared away and flourishing settlements are well known to occur, as for example in Ceylon and other places; but our business is rather to describe the equatorial zone as it generally exists, under its natural aspects, throughout by far the largest portion of its area—namely, that of a great region of primeval forests.

If we take the map, and run our eye over the equatorial regions, and think of the conditions of the countries traversed by the equator, we shall find that this description of it is, in the main, substantially correct.

The principal portion of its terrestrial surface, as will be seen, lies in Africa and South America. In Africa, so far as is known, over by far the greater part of this area the primeval forest extends almost from sea to sea. Where exceptions to this rule are found to occur, they can in all probability be traced to peculiarities of soil, or to a great elevation of the land above sea-level: the more luxuriant and heavier forest growths usually existing on the western half of the continent; and the more open and dwarfer forest upon its eastern side—while so far as human progress is concerned, practically nothing has been

effected, unless a few small trading posts upon the coasts deserve the name. The rest is the abode of wandering tribes of savages of the lowest type, but at the same time probably the most ancient of any now existing races of the human family. So little was known of this region that it was only the expeditions led by Mr. Stanley which have lately announced to the world that the vast forests of the Upper Congo existed at all; and what their area may be is still unknown.

If we take the case of the equatorial regions in South America, substantially the same description holds good with regard to them. A few travellers have here and there penetrated the wilderness by the aid of the numerous great rivers that there find their way through the forest to the sea—but only to tell us that by far the greater part of it is a great forest country with occasional open and elevated plains, mostly inhabited by races of hopeless savages, less ancient, perhaps, than their African brothers, but still very old. A few scattered bands of white settlers have, however, located themselves upon the banks of the principal rivers, and there, by the aid of negro slaves, contrive to maintain a precarious existence, principally by trading in the raw products of the forest—and that is all.

Proceeding then towards the far east, we find in the Malay Archipelago, and other portions of territory included within the equatorial zone in that region, the same story practically repeated—forests, nothing but forests, almost everywhere, inhabited by copper-coloured races of whom comparatively little is known. These great islands are, it is true, marked upon the map as "British," "Dutch," or "German," etc., but their rule, except at a few points, is merely nominal, only a com-

paratively small portion of the whole country being under their direct administration—the real ruler for the most part is the spirit of the wilderness. Indeed, except at Singapore and Batavia, both of which are flourishing settlements, and a few other points, there are hardly any considerable exceptions to this rule.

But as we proceed towards the northern limits of the equatorial zone, as for example, to Ceylon, and Southern India—we find the wet and dry seasons gradually becoming more and more clearly marked, and as they become so, the evidences of human occupation increase. The same thing we find repeated upon the great American continent upon a lesser scale; and though there can be no doubt that the whole of this country was originally one vast forest region, the numerous and industrious populations, living together in village communities, have by degrees brought large areas under cultivation. In Ceylon, for instance, the population is nearly two and a half millions, and there are numerous European settlers; nevertheless, the "British Encyclopædia" tells us that generally even now "the summits of the highest ridges are clothed with verdure, while the slopes of the hills, till the last few years, were covered with forests of gigantic and valuable trees, which have now disappeared under the axe of the planter—" *

Under the able administration of British rulers the prosperity and trade of the island, we are happy to say, have of late years enormously increased—but though enormous clearances have been made for tea estates there are large areas of land still buried under an almost impenetrable forest-growth.

* *Encycl. Brit.*, 9th edit., Vol. v., pp. 359 to 365—Article "Ceylon."

The same observations may be said to apply to Southern Hindustan; both there, and in Ceylon, numerous ruins and other historical remains bear evidence of a very ancient prosperity, shown by the existence of extensive tanks, dams, and other hydraulic engineering works; as well as by the remains of ancient cities and temples, which conclusively prove the former existence of large populations which had attained to a high state of civilization. Nor are similar indications uncommon in America; even in Africa similar remains have been found. But what has become of all these numerous and prosperous communities? and why have they abandoned the homes of their fathers?—Historical considerations of this kind are, of course, somewhat foreign to the general scope of our subject. In works relating to the history of ancient eastern civilizations, however, there seems to be a general disposition to attribute the disappearance of these peoples to wars, or civil commotions. All that we shall venture to say on this head is, that though the losses due to those causes may often have been enormous, they have rarely or never been proved to be capable of destroying as fast as the bounty of Nature has been able to reconstitute.

It can easily be shown, by way of analogy, for instance, that notwithstanding all the great public calamities, wars, pestilences, and troubles of every kind, which have afflicted Europe almost from time immemorial, and in spite of the enormous emigration of the last two or three hundred years, both wealth and population have constantly increased there. Why should it be different in Asia?—In a splendid passage in his "History of England," Lord Macaulay has pointed

out the same fact, with regard to the increase of capital in our own country.

"It has often been found," he says, "that profuse expenditure, heavy taxation, absurd commercial restrictions, corrupt tribunals, disastrous wars, persecutions, seditions, conflagrations, inundations, have not been able to destroy capital so fast as the exertions of private citizens have been able to create it." *

And he proceeds to remind us that throughout the long civil war which was waged between Charles I. and his Parliament, and also after the cessation of active hostilities, when—"13 years followed, during which England was, under various forms and names, really governed by the sword" †—this growth of material prosperity was still kept up. He might with equal truth have added, that notwithstanding all these infinite calamities, population as well as wealth had slowly but still continuously increased. He, however, confines his observations here to the increase of capital: a commodity which, during such a time, might well have been expected to show a decline—yet in spite of everything this national wealth (which after all is the truest test of prosperity) kept steadily increasing; and he maintains,

"that in spite of sieges, and confiscations, it was greater on the day of the Restoration than on the day when the long Parliament met;" that "in spite of mal-administration, of extravagance, of public bankruptcy, of two costly and unsuccessful wars, of the pestilence, and of the fire, it was greater on the day of the death of Charles II. than on the day of his restoration." §

* *History of England*, by Macaulay, 1866, Vol. i, pp. 279—80.
† *Ibid.*, p. 120.
§ *Ibid.*, pp. 279—80.

These are remarkable facts, and they speak volumes for the robust tenacity and vitality of the British race.

How then can we account for the disappearance of whole races of mankind, and the total abandonment of the great cities of antiquity, which we find constantly recorded in oriental history? Might not these things have been due to *Pestilence*, rather than to misrule or the incursions of hordes of barbaric conquerors?

We know that whenever a numerous population is gathered together under insanitary conditions, beneath the influence of a powerful sun, epidemics of malignant character are certain to follow, and that so long as these conditions continue disease is likely to prove endemic. We can scarcely therefore be surprised if, in these cases of the great cities of antiquity, it should eventually have necessitated their complete evacuation; especially in an age of superstition, when pestilence was always regarded as of supernatural origin, sent in fact, "as a punishment from Heaven, because of the sins of the people." There can be no doubt, if we may venture so to express it, that there is a sin which is certain to bring pestilence upon a city, and that is—neglect of the sanitary laws of Nature. If there is one precept of the natural law more clearly laid down for our guidance than any other, so that he who runs may read, it is that, "Where there is dirt, there will be disease." It is desirable, therefore, not to lose sight of these facts when seeking for the probable cause of the abandonment of ancient cities and great works of national utility, with which India, Ceylon, Mexico, Egypt, and other countries are replete.

Here perhaps we could not do better than cite a remarkable instance, occurring in our own day, where enormous losses, considering the number of the population, have been recorded, which at one time bid fair to depopulate the whole surrounding country. This calamity took place in a dry and almost rainless district, which furnishes a most curious example of one of these exceptional variations of climate, such as are occasionally, as we have stated, to be met with in the equatorial zone.

We refer to the famine and pestilence which committed such havoc in the province of Ceara, on the north-east coast of Brazil. Though situated well within the equatorial zone, only a few degrees to the southwards of the equator, Ceara is a dry, hot, and almost rainless region, with cool nights, and intense solar heats by day, much more characteristic of the desert, than of the equatorial zone. The Brazilian "Sertao" or wilderness here forms a broad belt of wide sandy plains and bush, lying to the southward of the Amazonian forests at this point, where there are long dry seasons. During the prevalence of a prolonged drought in 1877—78 (co-temporary with the great Indian and Chinese famines), three quarters of a million of people are stated, on good authority, to have here died of disease and starvation, in the eight provinces of eastern and central Brazil. The prevailing types of disease were a form of black small-pox of malignant character, and a relapsing fever of typhus-like nature which is often found to follow in the train of famine. The mortality which followed the Irish famine of 1846, for instance, was due to a fever of this type. In the case at present before us,

however, "in (the town and province of) Ceara alone, above half a million, or more than one half the population, died."*

If so great a mortality could occur in the present age in spite of the advance of modern science and knowledge, what might not have taken place during the dark ages when the grossest ignorance and superstition prevailed!

If we proceed to seek for an explanation of so great an apparent anomaly as the occurrence of this dry desert region, existing in the moist and rainy equatorial zone, the only reason that can be assigned for it seems to be that suggested by Mr. Wallace—"that the sandy soil and bare hills produce ascending currents of heated air, which prevent condensation at this point." †

Anomalies of this kind, however, will be found to occur in each of the terrestrial zones, as islands appear here and there to rise above the surface of the ocean, or a fertile oasis is found to exist in the midst of the desert.

We must next turn our attention to the consideration of the primeval forest, which constitutes the characteristic feature of the equatorial zone, and covers by far the greater proportion of its surface.

It would indeed require the pen of a ready writer to do justice to, or even to attempt to portray, in adequate terms, the magnificence, and the marvels of these great, almost boundless, wildernesses of tangled vegetation; where gigantic trees, and creepers of every

* *Brazil, the Amazon and the Coast*, by Herbert H. Smith, 1880, p. 410.

† See *Tropical Nature*, by Alfred R. Wallace, 1878, p. 19.

kind, interlace and crowd each other out of existence, throughout an immense expanse of territory, most of it apparently teeming with exhaustless fertility; but concerning whose productions, or whose resources, practically nothing is known. One of the very latest additions to geographical science, for example, as we have already mentioned, was the discovery of the great forests of the Upper Congo, of whose very existence the world had previously been ignorant.

We may all remember how geographers not content with simply marking upon our school atlases, this region as "unknown," persisted in representing the interior of Africa as a vast expanse of sandy desert—although reflective minds, arguing from analogy, might very fairly have ventured to conclude that the probabilities were all in favour of the supposition that the characteristic features of the equatorial zone, as a great forest region, would be found to exist there also; especially when numerous great rivers were known to roll down to the ocean, whose volume precluded the idea of their proceeding from tracts of waterless deserts or indeed from anything but a region of rains, whose certain effect would, under the influence of a tropical sun, be to cause a luxuriant vegetation to spring up, even from a sterile soil. But that even learned men, buried too often in the acquisition of useless lore, entirely failed to decipher so plain a passage from the great book of Nature, need cause us no surprise: it only emphasizes, what we knew before, that man is but a poor prophet, even the most far-seeing being but too apt to be led away by erroneous fancies, while they are blind to palpable facts, daily paraded under their very eyes.

Any estimate as to the probable extent of this great Central African forest, discovered by Mr. Stanley, must of course at present be merely conjecture; but from the information he could gather, he is disposed to think that the immense area of upwards of 350,000 square miles is covered by one practically unbroken forest in this region. *

Mr. Stanley, as his steamers ascended the Congo and the Aruwhimi to a point where it was evident that further progress would have to be by land, had already passed through immense tracts of forest, which formed one almost unbroken frontage along the river bank. He briefly describes the country traversed during his now celebrated march, as follows:

"I had been very curious about the limits of this forest that lay dark and dismal before us, on all sides. I had asked every native about this forest, but they had never heard of any limits to it. We marched onwards without a single day's rest, for one month, daily hewing our way through the dense undergrowth. So dense is the forest that you seldom see the sunlight; a mere shaft of light, or a glint of sunshine, is all we ever saw of the broad daylight and the bright blue sky without. After 160 days, we emerged out of the forest and came into the sunshine, and literally raced through the grassland, like wanton children, so rejoiced were we at beholding the blue sky, at feeling the pure breeze, and seeing the tender grass before us." †

And again in his official report he tells us—

"The journey we were about to undertake was through one continuous unbroken forest. Though daily expecting to

* See report of Mr. Stanley's speech at a meeting of the R.G.S., reported in the *Times* of May 6, 1890.

† Extract report of speech by Mr. Stanley, at a banquet offered him by the Egyptian Government at Cairo, Jan. 20, 1890, in *Times*, Feb. 14, 1890.

hear from natives some news of a grassy country to the north, south, or east of them, it was not until we were seven days' march from the grassy region that we came across any that had ever heard of grass land; to the rest, all the world was overgrown with one endless forest. We had neither seen nor heard of any open space, save the clearings that had been laboriously made by the natives, and had to be every season subjected to laborious cutting, lest the forest should usurp what cultivated space had been gained."—"Our progress through the dense underwood, which grew beneath the impervious shades of the forest giants matted by great cable-like convolvuli, was often only at the rate of 400 yards an hour, as through such obstructions we had to tunnel a way for the column to pass." *

This column, it seems, on entering the forest originally consisted of 389 men, but only 173 came out on the other side. † The rest had died, or had to be left behind, disabled by terrible ulcers on the feet and legs, which incapacitated them from travelling; semi-starvation, poisoned arrows, and desertion, caused most of the remaining losses. § Others again straggled from the route in search of bananas, or other food, and were never more heard of; for, as Mr. Stanley himself reminds us, "it is useless to search in the forest for a lost man, donkey, or article. Like the waves of the sea, divided by the ship's prow, uniting at the stern; so the forest enfolds, past finding, within its deep shades, whosoever enters, and reveals nothing." **

All the accounts which have been published about this great forest show that it is pretty well everywhere

* Extract from Mr. Stanley's official report of his expedition, of December 18, 1889—published in the *Times* of Feb. 18, 1890.

† *Ibid.* § *Ibid.*

** *In Darkest Africa*, by H. M. Stanley, 1890, Vol. i, p. 195.

thoroughly equatorial in its character; the gigantic trees, intermixed with others of smaller dimensions, being lashed together by millions of lianas and other creepers, forming a dense and tangled network of vegetable cordage. The trees also grow so thickly together, that their branches interlace, and form a canopy almost entirely impenetrable to sunlight; a solemn gloom therefore constantly pervades the recesses of these forests, amounting even on fine days to a regular twilight, while with misty or rainy weather, the page of a book becomes unreadable. * In the morning the march is generally delayed in forests of this dense character for a considerable time after the sun is up, before there is sufficient light to enable travellers to see their way; while by night of course the darkness is something so intense that it can almost be felt.

Now, in studying this question, we must always remember that the forest discovered by Stanley, large as it may be, bears but a very small proportion compared with the vast area of the great equatorial forest region, when taken as a whole, and that as Mr. Wallace has pointed out,

"with but few and unimportant exceptions, a great forest 'band'" (of this character) "from 1000 to 1500 miles in width, girdles the earth at the Equator, clothing hill, plain, and mountain, with an evergreen mantle. Lofty peaks are sometimes bare, but often the woody covering continues to a height of eight or ten thousand feet." †

And, while the late discoveries have served to fill up *a gap* upon the map of Africa, they merely tend

* Report of a speech by Mr. Stanley at a meeting of the Royal Geographical Society, in *Times* of May 6, 1890.

† *Tropical Nature*, by Alfred R. Wallace, 1878, p. 27.

to corroborate the information furnished by a perusal of the works of previous travellers, which goes far, when coupled with this new discovery, to establish the fact that a great and almost unbroken zone of forest country extends, as we have stated, more or less continuously, right across the central portion of the African continent. The occurrence of open grassy plains, at some points of the interior highlands, as reported by Mr. Stanley and others, is only what might be expected, when we consider the great elevation of the land above sea-level, and the variations of soil, sure to occur in so vast an extent of territory. So far as can be judged from our present sources of information, however, it seems probable that the forest again extends far, both to the northward and southward, of these plains; but of course the whole of it is probably not altogether so dense in its character as that passed through by Mr. Stanley, upon the upper waters of the Congo.

As we approach the region of intermittent rains, open spaces may be expected to become more frequent; while stretches of "grass forest," consisting of bamboos and other gigantic arborescent grasses, will be found alternating with the heavier forests.

Those who may have honoured us with an attentive perusal of the preceding portions of this section, will doubtless have observed that we have extended the limit of the equatorial forest zone considerably beyond that adopted by Mr. Wallace, who has fixed it at $12\frac{1}{2}$ degrees north and south of the equator;* whilst we have followed what is known as "*Meyen's division*" of 15^0—because wherever there is a hot, moist atmo-

* *Tropical Nature*, p. 3.

sphere, and a damp soil, a forest of the equatorial character will be found pushing up into our next division—"The Great Bush Country."

This, Mr. Wallace seems practically to admit, for he is careful to point out that "beyond the forests both to the north and south, we first meet with woody, and then open country, soon changing into arid plains, and even deserts in the vicinity of the two tropics." * This woody and open (or rather "park-like") country is what constitutes the bush region, which runs in, at intervals, among the heavy forests, at its equatorial margin, and up into the desert zone adjoining, according as the nature and extent of moisture contained in the soil and atmosphere may determine.

Reverting, however, to our consideration of the equatorial forest belt, precisely the same conditions and description of forest existing upon the African continent are likewise found to recur in America. In the great Amazonian forest region, for instance, Mr. Wallace states that—"a circle 1100 miles in diameter could be drawn within its limits." †

This enormous forest—whose area, like that of its African rival, is still most imperfectly known—has usually been held by writers upon these subjects to be the most wonderful example as well as the most perfect type of the equatorial forest in existence, and very little of it has been regularly explored.

The following picturesque description of a traveller's sensations when about to enter its shades is from the pen of Mr. Herbert H. Smith, an American who has recently returned from Brazil:

* *Tropical Nature*, by Alfred R. Wallace, 1878, p. 28.
† *The Amazon and the Rio Negro*, by A. R. Wallace, 1853.

"We find" (he says) "a path like a tunnel; thick branches meet overhead, and almost conceal the entrance. The air strikes cool in our faces, and coming in out of the glare we can hardly see at first, so dark is it. You are aware of a maze of trunks, a web confusing to the eye and mind. There are tree trunks and a multitude of vine stems. Near the ground there are not many leaves, but overhead the boughs are woven thick like a mat. You can see the blue sky only in little patches; stray beams reach the ground sometimes; but all around there is only the solemn diffuse light." *— "It is only" (he continues) "after you have spent days and weeks here, that you can reason on what you see. You feel insignificant, even more than on the ocean; at sea there is always the horizon, and a definite boundary to vision; alone in the forest, your insignificance is forced upon you: you gaze through the net-work of leaves and tree trunks, until the vision is lost, you know not where. You know that you have only passed the borders of this infinity, where you could go on for weeks, months, and never reach the end. You are alone utterly: an army of men could not find you; your dearest friend, your most hated foe, could not track you; the vultures could not find your body, if you died here; you could not find your way out, but by the path you came over, or the noted direction; and very few men will care to go into the forest without companions." †

In fact it is obvious that it would be madness to attempt to do so, unless accompanied by trustworthy native guides, or someone skilled in local woodcraft. Even in the far more open and less confusing mazes of the North American forests, the instances of persons who have from time to time lost their lives, by foolishly straying into the woods alone, are common; but

* *Brazil, the Amazon and the Coast*, by Herbert H. Smith, 1880, pp. 179—180.

† *Ibid.*, pp. 185—186.

this serious casualty of "getting lost," dangerous enough in an ordinary forest, becomes almost certain death in such a region as we are now describing. In the equatorial forest, it is in fact perilous to stray from the path, *even for a few yards*, as, on account of the numerous obstacles, it is impossible to hold a straight course for any distance, the direction during a very short progress heading towards every point of the compass, so that a stranger soon loses his idea of direction. Mr. H. H. Smith while travelling in the Brazilian forests states that he engaged the services of two Indians as guides, and each man carried a hammock, blanket, sack of mandioca meal, wood-knife and calabash of water; some of the party also had guns and fishing tackle.

In these countries a "Machete," or species of stout slashing knife, with which to cut through obstructive trailing creepers, forms a necessary part of a man's equipment, without which it would be impossible to travel far. Mr. Stanley's expedition seems likewise to have been well supplied with various kinds of cutting weapons, and special precautions against getting lost were wisely adopted, in marking the track, as they passed along; the orders being that—

"Each man as he walked along, should choose an obstructing liana or branch, and give one sharp cut and pass on: the two head men confining themselves to an effective and broad blaze, on the trees, every ten yards or so. As the rear party would not follow for two months, we were very particular" (says Mr. Stanley) "that these blazes should be quite a hand's breadth peel of bark." *

It is to be feared, however, that in many places the

* *In Darkest Africa*, by Henry M. Stanley, 1890, Vol. i, p. 142.

rapid growth in the equatorial forests would, in a very short time, blot out all trace of a former path. Among the galleries formed under the heavier timber, sometimes bearing a close resemblance to the aisle of a great cathedral, the shade is, however, so deep that vegetation proceeds at a very much slower rate, and the ground in these places is often bare. In these portions of the forest therefore, marks might remain visible for a considerable time.

The size of the South American forests is greatly curtailed to the westward by the lofty snow-clad range of the Andes, whose cold altitudes cause the condensation of the aqueous vapour, with which the atmosphere is charged, to take place upon their eastern slopes, where it falls in copious rains, as the enormous river systems upon that side sufficiently attest. The wind then descends upon their western slopes, as dry air; with the result that might have been anticipated, namely, that (except at points where the incessant rains prevail, in Ecuador and New Granada) the heavy forest disappears, and a stunted bush, or arid plains, take its place, affording (if that were needed) another proof of how entirely these forests depend for their existence upon a moist atmosphere and damp soil; combined, of course, with tropical heat.

The remarkable difference of the climates to the eastward and westward of the Cordilleras, has always excited the astonishment of beholders; for surely nothing can be more striking than the intensely damp rainy climate and exuberant vegetation on one side, and the sterile, arid country, perishing for want of water, on the other. Generally, however, this has been set down to some freak of Nature. But Nature is not given to cause-

less freaks, and the foregoing, as we humbly submit, is the simple explanation which, together with the direction of the prevailing winds, accounts, if not altogether, at any rate mainly, for this apparently strange anomaly.

The forest region of South America is, in effect, stopped by these mountains, to the westward, as effectively as it is by the ocean upon its eastern coast; but it extends for an immense distance both northwards and southwards, eastward of the Andes. Its northern boundaries, in fact, correspond with the coast line, but the forest is again found running for an altogether exceptional distance into Central America, where on account of the prevailing winds, heavily charged with moisture, magnificent forests, thoroughly equatorial in their character, occupy pretty well the whole of the "Tierras Calientes" or hot districts on both coasts, considerably beyond the limits of our equatorial zone.

It would be almost impossible within reasonable limits, to give an adequate idea of the variety and profusion of plant life which is to be seen growing in extraordinary luxuriance throughout the immense expanse of these great forests; whose inmost recesses have, in fact, as yet been only very partially explored: enormous areas of virgin forests, still existing almost everywhere throughout the equatorial zone, which have never been disturbed by the foot of civilized man. More especially is this so in Africa. Unfortunately, during the recent great march of Mr. Stanley, the difficulties of the journey, the scarcity of food, and hostility of the native tribes, seem to have rendered any attempt at botanical research impossible; so that

beyond the fact of our becoming aware of the existence of vast forests upon the upper waters of the Congo, and its tributary streams, very little has been added to our store of knowledge, so far as their vegetable products are concerned.

But who shall predict the possibilities of the future? It may well be that, as time goes on, future investigations may prove (and as we trust, will prove) that these forests enclose many trees and plants of great, and hitherto unknown, medicinal virtues; as well as numerous other treasures of the vegetable kingdom, which from a commercial, as well as from a horticultural, point of view, may perhaps prove as important to the welfare of mankind, and as valuable in a pecuniary sense, as any of the novelties heretofore introduced to the world from the Central and South American forests. We purpose presently to offer a few remarks with respect to a few of the principal of these botanical treasures of the western hemisphere: whose value, as we believe, is even yet but little appreciated at its true worth, by the general public.

From the fact of there being so little variation in the seasons, and the almost exclusively evergreen nature of the trees, the general aspect of forests truly equatorial in their character, as we have said, exhibits but little change at any period of the year. The traveller is also almost always disappointed, on his first arrival, by the apparent scarcity of brilliant flowers, and the few visible signs of animal life—not that there really is any scarcity of either the one or the other; but rather that these things are, so to speak, swallowed up in the vast extent of impenetrable thicket, which rises before one on every side like a living

wall of verdure. So that before a man can in any way realize the abundance of magnificent trees and other beautiful things these forests contain, he must pass some time in exploration.

The late Major Levison, the well-known sportsman, (who wrote under the *nom-de-plume* of H.A.L. "The Old Shekarry") for instance, in describing his trip into the deadly forest region of the Gaboon, in Western Africa, was greatly struck by the exuberant wealth of its vegetation, and the splendid timber it contained.

"Some of the forest trees" (he says) "were of gigantic size, having their trunks, which often rose straight for a hundred feet without throwing out a branch, entwined with a festoon of beautiful parasitical plants." *—And again—"In some parts of the forest a kind of frankincense tree fills the air with a perfume that is almost oppressive; and I often fell in with magnificent forest trees that were perfectly new to me, for which the natives appear to have no name." —"In one patch of forest I came across a beautiful small lake covered with waterlilies, having large leaves resembling those of the Victoria Regina, and here I saw a couple of 'lotus birds.'" †

Baron Humboldt also, the great German philosopher and traveller, was evidently deeply impressed upon his first arrival in the equatorial regions, by the luxuriance and beauty of Nature, and tells us that—

"He is unable to determine *what* most excites his admiration: the solemn stillness of the wilderness, or the individual beauty and contrast of forms, or the vigour and freshness of vegetable life, which characterize the climate of the tropics." §

* *The Forest and the Field*, by H. A. L., "The Old Shekarry" (Major H. A. Levison); 2nd edit., 1867, p. 402.

† *Ibid.*, pp. 448—449.

§ *Travels*, by Baron von Humboldt.

As regards the dearth of flowers Mr. Wallace observes that—

"in the great virgin forests themselves, flowers are rarely seen."*—"You may" (he explains) "travel for 100 miles, and see nothing but the varied greens of the forest foliage, and the deep gloom of its tangled recesses."†—"Sometimes a tree appears covered with beautiful flowers which do not belong to it, but to one of the lianas that twine through its branches, and send down great rope-like stems to the ground. Sometimes the ground is carpeted with large flowers, yellow, pink, or white, that have fallen from some invisible tree tops above, or the air is filled with a delicious perfume, the source of which one seeks in vain, for the flowers that cause it are far overhead out of sight, lost in the great overshadowing crown of verdure."§—"When for the first time" (Mr. Wallace goes on to say) "the traveller wanders in these primeval forests, he can scarcely fail to experience sensations of awe, akin to those excited by the trackless ocean or the Alpine snowfields. There is a vastness, a solemnity, a gloom, a sense of solitude, and of human insignificance, which for a time overwhelm him."** "We often read in books of travels of the silence and gloom of the Brazilian forests; they are realities, and the impression deepens on a longer acquaintance."††

The few sounds of birds and animals which break the stillness are generally very harsh and unmusical, and keep up the feeling of inhospitable wildness which the forest is calculated to inspire, the musical notes of song birds being rarely or never heard there.

In our consideration of the equatorial forest, as *a*

* *Tropical Nature*, by Alfred R. Wallace. 1878, p. 61.
† *Ibid.*, p. 62.
§ Bett's *Naturalist in Nicaragua*, quoted by Mr. Wallace, in his *Tropical Nature*, pp. 62—63.
** *Tropical Nature*, by A. R. Wallace, p. 67.
†† *Ibid.*, p. 71.

forest, we must, however, never forget that it consists not of one, but of several distinct tiers of vegetation, rising one above the other. Just as a lofty building has its different stories, so the forest has its different gradations; beginning at the top with lofty trees of gigantic growth, having beneath them a second, and even a third forest, of smaller, shade-loving trees, of various sizes, beneath which again are other undergrowths, consisting of ferns, and herbaceous plants of different kinds, often extending in a matted covert down to the very ground itself. Mr. Wallace, in his charming and instructive work upon Tropical Nature, furnishes us with the following graphic description of one of these forest landscapes:

"The observer new to the scene is first struck by the varied, yet symmetrical trunks, which rise up with perfect straightness, to a great height, without a branch, and which, being placed at a considerable distance apart, give an impression similar to that produced by the columns of some enormous building. Overhead, at a height of perhaps a hundred feet, is an almost unbroken canopy of foliage."—"Usually so dense, that but an indistinct glimmer of the sky is to be seen."—"There is a weird gloom, and a solemn silence, which combine to produce a sense of the vast, the primeval, almost of the infinite. It is a world in which man seems an intruder." *

Dr. Schweinfurth, the well-known German traveller in Central Africa, speaks to the same effect, as regards these giant trees in the forests of the Southern Niam-Niam country:

"Some of the trees" (he says) "were ten feet in diameter at the base, and had a bark without a wrinkle; not infre-

* *Tropical Nature*, by Alfred R. Wallace, 1878, p. 30.

quently they rose up to a height of forty feet, without a single branch, standing as it were, like the columns of a thousand years, in the Piazzas of the Eternal City." *

So also the late Mr. Joseph Thomson, describing the forest growing on the foot hills of the Unambara mountains, in Eastern Africa, opposite Zanzibar, says:

"It was indeed a marvellous forest—every tree a vegetable giant, rising 70 or 100 feet before branching, and then forming a parachute-shaped crown, through which the rays of the sun in vain attempted to penetrate. Little less gigantic than the trees were the creepers—none of your slender convolvuli or ivies, but massive fellows, as thick as a man's thigh, hanging aloft from tree to tree, or twisting up their stems. Everything was strange, grand, and colossal." †—Many of the trees," (he goes on to say) "had crowns of leaves three feet long by one foot in breadth," §

and the consequent twilight beneath their shade was so deep, that he informs us: "We actually had to wait an hour, after the sun rose, before we had sufficient light to enable us to proceed." **

This dense canopy of foliage, it is desirable to bear in mind, consists not merely of the leaves of these great trees themselves, but also of those of the innumerable lianas which spread themselves, like matted cordage, all over their tops, just as water plants rise up from the bottom, and spread themselves over the surface of a pond, exposed to the air and sunshine. Moreover, all this mass of verdure, by excluding the air and sunlight, acts as a condenser to the vapours, continually rising from a soil saturated by the tre-

* *The Heart of Africa*, by Dr. Schweinfurth, 2nd edit., 1874, Vol. i, p. 528.

† *To the Central African Lakes and Back*, by Joseph Thomson, Vol. i, p. 52. § *Ibid.*, p. 56. ** *Ibid.*, p. 55.

mendous rainfall, characteristic of the equatorial regions —so that a vast natural stove-house, with an atmosphere precisely similar to that of an orchid house at home, is perpetually kept up in the umbrageous arcades thus created beneath.

Here, the numerous shade and moisture-loving tropical trees of the larger size find their natural habitat, and form a *second forest* of medium sized trees, whose crowns do not touch the lowermost branches of the trees above. These are, perhaps, from forty to sixty feet in height, or even more, if circumstances permit their growing to a greater height, beneath the protection of their more gigantic and sun-loving neighbours—and it is among this class of trees that many of the treasures of the tropical forest are numbered—so far, that is, as this vast treasure house of Nature has as yet been explored and its products made known to the world.

Beneath this second forest, in the still deeper shadows below, *a third forest* is often found, consisting of still smaller trees, ten or twelve feet high, among, or beneath which, are numerous dwarf palms, tree ferns, and gigantic herbaceous plants,—and lastly,

"coming to the surface of the ground itself, we find much variety. Sometimes it is completely bare, a mass of decaying vegetation. More frequently it is covered with a dense carpet of selaginella, and other lycopodiaceæ, and these sometimes give place to a variety of herbaceous plants, sometimes with pretty but rarely with conspicuous flowers." *

The marvellous beauty and richness of some of this undergrowth is a thing that must be seen before it can be realized; suffice it to say, that many of the

* *Tropical Nature*, by Alfred R. Wallace, 1878, p. 34.

gems of our stove-houses have been collected here. The tree ferns, for instance, are often marvels of exquisite grace and delicate freshness of colouring. The largest and finest specimens of these beautiful plants generally, however, occupy small openings among the trees where their crowns are exposed to the sunlight. Nothing can exceed their grandeur and beauty. Thus Mr. Thomson, after recounting the glories of the giant trees of the Unambara forest, exclaims—

"All these arboreal wonders were forgotten as my eye lighted upon a lovely group of tree ferns, growing beside a rocky stream, with straight stems twenty feet high, topped by a delicate green crown of fronds. This part of the country proved a very paradise of ferns." *

It is in such places as these, along the banks of streams flowing through ravines and deep channels that the wonderful "*gallery forests*," first brought to the notice of the world by Dr. Schweinfurth, are to be found. But we shall leave the learned Doctor to speak for himself on this subject:

"Here too," (he says) "was unfolded the full glory of what we shall in future understand as a 'gallery'—these are tracts of brook vegetation, within deep-cut channels, that form, as it were, walls to confine the rippling stream, so that all the vales are permanently adorned with tropical luxuriance." †

In almost all damp tropical climates, the beds of ravines and stream courses here and there present scenes of fairy-like loveliness, these places forming a series of shady grottoes, where delicate ferns and other shade-loving plants flourish in unsurpassable beauty. Dr. Schweinfurth was at this time travelling through

* *To the Central African Lakes and Back*, by Joseph Thomson, Vol. i., p. 56.

† *The Heart of Africa*, by Dr. Georg Schweinfurth, Vol. i., pp. 504—5.

the Niam-Niam country, a part of Central Africa, till then almost entirely unknown, where these wonderful arcades, or "galleries," of the most striking and beautiful character, were often met with—

"trees with immense stems, surpassing all we had elsewhere seen," (he tells us) "here stood in masses. At intervals, some less towering forms rose beneath their shade—and in the inmost recesses of these woods one would come upon avenues like the colonnades of an Egyptian temple, veiled in the leafy shade of the triple roof above. Seen from without, they appeared impenetrable forests, but within they opened into aisles and corridors, which were musical with many a murmuring fountain." *

In Ceylon, however, and in most other countries situated within the equatorial zone, similar examples of these extraordinary natural galleries are of frequent occurrence—the interior of this beautiful island being a succession of mountains and ravines, with precipitous sides, at the bottom of each of which a crystal brook may generally be heard dashing along its rocky bed.

One might go on, almost to infinity, in the hopeless effort to recount even a tithe of the wonders and beauties of these forest scenes, which once seen can never be forgotten;—after long years have passed, the memory of them never fails to rise up again, from time to time, in the mind's eye, as among the scenes which we feel to be most wonderful, and best worth seeing in the experiences of a lifetime. In the common course of Nature, much that we think well worth seeing, at the moment, fades out of recollection entirely, or else when looked back upon, appears tedious, or common-

* *The Heart of Africa*, by Dr. Georg Schweinfurth, 2nd Edit., 1874, Vol. i., p. 506.

place, such in fact as we should never care to see again.

But one of the glories of a traveller's life is that these wonderful instances of the boundless wealth and magnificence of the works of Nature never pall upon our recollection. They are among the very few things that seem never to grow old, but always, so long as life itself may last, form bright pictures, which the memory loves to dwell upon.

Unfortunately, on account of their inaccessibility and a vague fear of the deadly nature of the climate, the equatorial forest scenes are witnessed under their finest aspects by an infinitesimally small number of our travelling community, though almost every vegetable treasure both known and unknown, of the tropical world, is to be found in them. Now, though it is impossible to deny that Europeans travelling in these regions always incur a certain amount of risk from malarial fever, etc., yet so long as the country is not of a low-lying, swampy nature, recent experiences seem to point to the conclusion that the risk is not always so great as is generally supposed: for it is worthy of note that so long as the Emin Pasha Relief Expedition, in its progress across the African continent, remained in the forest, they suffered comparatively little from fever, and it was of very mild types in those few cases that did occur; but when they reached the grass land, and got into the open bush country, all the Europeans, almost without exception, suffered severely.* These facts rather seem to point to the conclusion that the direct rays of the vertical sun have, at any rate under certain conditions, a considerable influence in predisposing to attacks of fever. It is also probable that the malarial

* *Darkest Africa*, by H. M. Stanley, 1890, Vol. ii., pp. 31—33.

germs diffused through the atmosphere, are to a great extent absorbed by trees; this is, however, a technical question, which cannot well be considered here—and we must bring this portion of the present section to a close, after a brief survey of the most remarkable items among the vegetable productions of these forests.

As curiosities, the buttressed trees, air roots, bamboos, rattans, and other trailing creepers, each deserve a few words of passing mention. As regards the first, they are an evident provision of Nature to anchor the trees more securely in the ground. These buttressed trees are of all sorts and sizes; besides those of gigantic size and girth, there are many species that shoot up to a great height, though the diameter of the trunks is singularly small; the buttress system seems peculiarly well adapted to these cases, as it furnishes a strong, light, and efficient support, consisting of projections which resemble in some measure thin boards, laid edge-ways, as struts, against the trees. According to Mr. Wallace, who seems to have given these matters particular attention, "they rise to varied heights on the tree, from five or six, to twenty or thirty feet, and are sometimes so large that the spaces between them, if roofed over, would form huts capable of containing several people." *

These curious buttresses are found to occur in a good many different varieties of trees, in the tropical forests and jungles, and do not seem to be peculiar to any one particular genus. Sometimes they occur of very large size proportionately, in tall growing trees of slender girth; and again, they are seen propping up the huge trunk of some giant of the primeval

* *Tropical Nature*, by A. R. Wallace, 1878, p. 31.

forest, whose lofty crown towers high above the surrounding timber, where it seems to stand alone in its grandeur, without any other tree of a similar species near it. The height of some of these great trees, and the consequent distance of the leafy crown above the observer's head, but above all, the mass of trailing creepers which spread themselves over it, often render it difficult to determine what sort of tree it is which thus excites our wonder and admiration. This will also probably account, to a certain extent, for the great difficulty that exists in obtaining information of a really reliable character about jungle trees in general; for until the trees are actually cut down, everything is more or less a matter of guess work, with those species which are not in common use for building and other purposes; and of which perhaps only a few specimens exist, scattered over a wide extent of country. Even in India or Ceylon, the natives can afford but little information about them; and if questioned on the subject, reply, "Me not know—He jungle tree!" * Nor can much more distinct information be obtained from planters and other white residents. "They are jungle trees"—that is all they can say about them.

But besides these peculiar buttressed roots, there is another way in which some of these great trees are anchored to the ground; for in addition to the ordinary roots descending into the ground, we often find the surface, for a considerable distance around the trunk, covered by what we shall call "surface roots," which stand out above the surface of the soil like the giant coils of an assemblage of enormous serpents. Some

* The word "*Jungle*," so common in the mouths of Europeans, is derived from the Hindu "*Jangla*," signifying *wild*.

of these great roots will sometimes protrude to a considerable height—often as high, and sometimes considerably higher, than a man's knee, so that it is no easy matter to step across them. These interlacing coils twist about in a most extraordinary manner, and often thickly cover a considerable surface, corresponding, we have sometimes thought, to a certain extent, with the spread of the branches overhead. A fairly good example of such roots is easily accessible to the inspection of visitors, on entering the Royal Botanic Gardens at Peradeniya, near Kandy, Ceylon, where a line of splendid specimens of the *Ficus Elastica*, or Asiatic caoutchouc-tree, may be seen exhibiting a large area of these "surface roots," covering the ground around their trunks, and without the view of their curious sinuosities being obstructed, as it often is in the jungle, by other growths of various kinds. It is obvious that these matted coils are another of the wise and curious provisions of Nature for enabling the trees to resist the terrific force of tornadoes, to which all tropical regions are subject,* which would otherwise soon level the largest trees with the earth; whereas when anchored in this way they could not possibly go down without uplifting in their fall a vast and ponderous mass of earth and stones, attached to these gigantic floors of roots, which thus form a regular pedestal to the parent tree, which cannot be overturned.

Air roots are another form of anchorage, of even still greater efficiency, while at the same time they also form a means of propagating fresh off-sets from

* Ceylon has, however, thus far, been singularly free from those destructive hurricanes which are so common in the Bay of Bengal.

the parent stem. In the temperate zone, we have rudimentary examples of both the former processes (buttresses and surface roots), but so far as we are aware, we have nothing at all to compare with the regular air roots of the equatorial forest: before roots can be made to spring from the branches of trees of the temperate zone they must in some way be brought into contact with materials, such as earth, vegetable refuse, water, etc., which form the food of plants; they will then, as we know, gradually throw off roots, and in many instances attach themselves to the soil. But in the equatorial forest, considerable numbers of trees form regular root fibres upon the under surface of their branches; which grow downwards, at first like a single hair, but, gradually acquiring strength and nourishment from the air itself, they soon reach the ground, and thus in a short time form an entirely new stem, which taking root grows independently of the parent tree, while at the same time it is anchored to it by immense branches which ensure their mutual stability, like the trusses of an iron girder bridge.

We ought perhaps to say that there are *two* totally distinct kinds of "air roots"—(1) those that drop from the branches, as already described; and (2) another kind that are given off from the stem, or trunk, of the tree itself, a short distance above the ground; and which descend like the others until they are rooted in the soil. As the trunk grows in height, these roots grow too, and thus sometimes become so increased in size and length that the tree appears to be mounted upon a natural scaffold, supported by struts formed of these roots. This class of air roots is well seen in many palms and other trees, especially in the various kinds of

"*Pandanus*" or "screw palms." In our own country the alder tree (*Alnus Glutinosa*) growing in places subject to flood, casts out roots of a somewhat similar kind; so do some of our cereal grasses, as for instance the wheat plant (*Triticum Sativum*) of our farms (especially when the plants have received an injury to the stem); in such cases wheat stalks will sometimes cast off root fibres above the ground, which push down so as to anchor the injured stem in the earth, and thus enable it to grow and perfect its seeds like its fellows. But these very minor examples of air roots from the temperate zone hardly deserve to be classed in the same category with the much more remarkable achievements of some of the tropical trees.

Thus, many of the numerous "*Ficus*" tribes, which are said to consist "of about one hundred species, varying in size from small leafed creepers, like ivy, to lofty trees of gigantic size" *—furnish us with conspicuous instances of this tendency to cast off air roots, of which we may cite the well-known banyan tree of India (*Ficus Indica—vel Bengalensis*) as a leading example, and as such we quote it, as its geographical range extends all over tropical Hindustan. A fine specimen of this wonderful tree, covering a large surface, with numerous stems, may be seen in the Royal Botanic Gardens at Calcutta. Dr. Hooker describes this tree as 80 feet high, and states that it threw an area 300 feet in diameter into a dark cool shade, fifty years ago. And nearer home, fair specimens are to be found in the Esbekiyeh Gardens, Cairo. In Australia, the

* See "*The Genus Ficus*" in Smith's *Dictionary of Economic Plants*, 1882.

streets and public gardens of Sydney and other towns exhibit numerous examples of this class of tree—notably of the *Ficus Macrophylla,* or Moreton Bay Fig, and other varieties of the genus indigenous to Queensland,* which already form large and shady avenues.

The Banyan tree, a perfect prodigy among the productions of the vegetable kingdom, is a native of the East Indies, where it grows to a vast size, branching to a great height, and throwing out these air roots from every limb, which gradually root themselves all round the parent stem, till a regular forest of trunks is formed, which if not interfered with, in the course of years form an impenetrable thicket through which a man cannot force his way, except where vacancies occur. They form, in fact, a regular fortification, which if directed by human skill and culture, might be made to assume any shape that might be desired, and be so arranged as to be completely impervious to attacks from without, but we are not aware that military engineers have ever availed themselves of its assistance in this way; though there seems no apparent reason why these growths of the banyan should not continue to extend, so long as the earth furnishes her sustenance.

There are many celebrated trees of this kind in

* The Australian varieties greatly resemble the *Ficus Elastica* of India, except in the colour of their young foliage, that of the Indian tree being of a delicate pinkish shade, while the Australian varieties (of which there are several) are generally brown, or of a somewhat brownish copper tint. All of these Australian figs, however, throw out air roots resembling those of the Indian Banyan (*F. Indica*) when in luxuriant growth. At Adelaide, however, we observed that these air roots were rare—probably because the atmosphere there is too dry and too cold in winter to suit these trees perfectly.

India, which are regarded by the natives as sacred memorials of the Divine beneficence. The stump of the famous "Akshai Bar," or Undecaying Banyan tree, is still an object of worship at Allahabad, and the presentation of a single piece of money at the temple there is supposed to procure as much merit as a thousand pieces elsewhere. * Also on the island in the river Nerbudda at Shukltirth, near Bharâch (or Broach) stands a celebrated banyan tree, called the "Kabir Vat" or the Fig tree of Kabir, which according to Forbes, is supposed to be the same tree as that described by 'Nearchus', the admiral of Alexander the Great (Tempo, about 327 B.C.). † This tree, it is said, "once covered an area so immense as to shelter 7000 men," and, "though now much reduced in size by destructive floods, the remainder is still nearly 2000 feet in circumference, and the trunks exceed 3000 in number." § A writer who visited this tree in 1819 states that,

"its lofty arches and colonnades, its immense festoons of roots, the extent of ground it covered, and its enormous trunks, proclaimed its great antiquity and struck him with awe, similar to that inspired by a fine gothic cathedral. I should," he says, "guess it to cover from three to four acres, and the fresh green of its thick foliage shows that it is still in the vigour of life. Its branches rise so high that many miles off it is a conspicuous object, standing out like a hill on the end of the island." **

The author of these pages himself made a pilgrimage to this great wonder of the vegetable creation,

* Murray's *Handbook for India and Ceylon*, 1892, p. 38.
† *Oriental Memories*, by Forbes, 1783. Vol. i, p. 26.
§ *Encycl. Brit.* Vol., iii., p. 348 (9th edit.).
** Transactions of the Bombay Literary Society.

in 1893; but he regrets to have to report that a great deal of it has been destroyed, according to the natives who live upon the spot, by floods from the Nerbudda; but we fear also that parts of it have been cut, and otherwise destroyed by man; bush fires had also passed through the underwood beneath it, during the previous dry season. The surrounding districts are almost entirely one vast cotton field; which is one of the finest cotton-producing districts in India.

Another great tree of a similar kind is the "Banyan-tree of Wairâtgarh," near Wai, a place famed in ancient Hindu legends, and easily reached, through enchanting rustic tropical scenery, from Poona. It is said "to shade an area, three quarters of an acre in extent,"—the space covered being in the shape of a very symmetrical oval—without anything growing underneath to impede the view, save the stems from the parent tree. Lady Falkland, * speaking of this tree, says,

"The shade was so complete, I could sit in the middle of the day without any covering on my head. The tree was of such a size that separate picnic parties might take place under it, and not interfere with each other. There were countless avenues, or rather aisles, like those of a church, the pale grey stems being the columns, which as the sun fell on them, glistened, in parts, like silver; and here and there were little recesses, like chapels, where the roots from the boughs formed themselves into delicate clustering pillars, up and down which little squirrels were chasing each other, while large monkeys were jumping from bough to bough." †

The leaves of the banyan, we may here remark,

* *Voyages and Travels*, by Lady Falkland, p. 173.

† See Murray's *Handbook of the Bombay Residency*, 2nd edit., 1881, p. 196.

are very similar to those of an old specimen of the *Ficus Elastica*, or Asiatic caoutchouc tree; they have the same dark green, glossy appearance, but are somewhat shorter and rounder in the point than those of the latter; and the foliage which grows thickly when the tree is in robust health, affords a most gratifying shade in hot weather. In the following lines from *Paradise Lost*, it seems most probable that Milton must make allusion to a tree of the Banyan species, when he says:

"So counselled he, and both together went
Into the thickest wood: there soon they chose
The fig tree, not that kind for food renowned,
But such as at this day, to Indians known,
In Malabar, or Deccan, spreads her arms,
Branching so broad and long, that in the ground
The tender twigs take root, and daughters grow
About the mother tree, a pillar'd shade,
High over-arched, and echoing walks between;
There oft the Indian herdsman shunning heat
Shelters in cool, and tends his pasturing herds." *

Dr. Livingstone, in his "African Travels," also mentions a magnificent banyan tree, which he saw growing in a village on the River Shire, near its entry into Lake Nyassa. † And he states that many fine trees of the same species are found dotted over the country, and that this tree "has been held sacred in Africa from the remotest times." § We venture to think, however, what Dr. Livingstone saw were probably specimens of the species known as "*Kigelia Pinnata*,"

* Milton's *Paradise Lost*, Book ix.

† See *The Expedition to the Zambesi*, by David Livingstone, 1868, p. 124. § *Ibid.*, p. 188.

an Abyssinian variety of Ficus which forms the representative of the Banyan tree in Africa; some fair specimens of it are to be seen in the Esbekiyeh Gardens at Cairo, where we were informed it was introduced from Central Africa by Dr. Georg Schweinfurth. This tree in many respects closely resembles the Indian banyan, and produces quantities of air roots in the same way; but there are certain differences in the leaves and fruit, which show that it is an entirely distinct variety. Its immense and curious looking fruit hangs from its branches like gigantic cucumbers pendant to the end of a string.

It is, however, not a little remarkable to find that the superstition so prevalent in Asia, respecting the supposed sanctity of the banyan tree, was observed by Dr. Livingstone to be in existence among the native tribes in this remote part of Central Africa, which at the time he visited it was an almost entirely unknown and unexplored region. The circumstance affords us another instance of the fact that extraordinary phenomena of Nature never pass unnoticed, and never fail to make a deep impression on the mind of the races of natural man, to whose imagination they always present themselves as special instances of Divine power: as such they are invariably regarded with feelings of awe and veneration, and are supposed to be invested with supernatural powers, as the probable seat of the Divine presence.

We need not go further to find a notable example of this sort than the sacred Bô-tree (*Ficus Religiosa*) of India and Ceylon, sometimes called the "Peepul," or poplar-leafed fig-tree, which is universally supposed by people professing the Buddhist faith, to be endowed

with peculiar sanctity; so much so, that at almost every temple a Bô-tree is found growing hard by, before which prayers are daily offered up by the faithful. About the tree itself, in the equatorial regions at all events, there is nothing very remarkable in appearance. To what then shall we attribute its supposed sacred character? According to the Buddhist records it is because "Gotama" received Buddhahood while reclining under the Bô-tree in Uruwala. But there can, we think, be little doubt that in this instance we must seek for the real source of its sacred character in its known destructive powers, which appear to the native mind to be clearly supernatural; and thus the scene of "Gotama Buddha" (the last of the series of 24 Buddhas) receiving perfection, is fixed as having taken place beneath the shade of this remarkable tree.

The seeds of the Bô-tree have a peculiar faculty for germinating in the crevices of ancient walls and buildings; there they develop, and the roots inserting themselves among the masonry, take fast hold, while others run down the face of the wall and root themselves in the ground at its base, till the tree, which quickly attains considerable size, being acted upon by the wind, gradually loosens the stone work, and so in an incredibly short space of time, in this region of marvellously rapid growths, reduces the finest works of human skill and labour to absolute ruin. An attentive observer may note illustrations of this kind almost all over India. The Peepul (Pipâl *Hindi*), otherwise the Bô-tree, does not cast down "air roots" from its branches, like the Banyan; but once the seed has germinated, either in a wall, or in the fork of another tree, its roots will gradually run down its surface, for any distance—it

may be often for many feet—until they reach the ground and take root there; when the parasite tree will, in a few years, form thick stems, and loosen or overturn the stone work, if it be a building; or choke the parent stem, if it be that of a living tree. Visitors to most of the ancient temples and other monuments of Indian antiquity will meet with numerous instances of this, and in the old walls of almost any of the ancient cities of India it may be seen doing the same thing to the stonework of their fabric. Even so far north as Delhi, if the tourist visiting this renowned fortress will take the trouble to go out of the Cashmere gate, along the ditch, past the breech made in the Water Bastion hard by, by the British cannon during the siege of 1857, and turning to the right passes along the river front beneath the city walls, he will in a short walk see several instances where these trees have rooted themselves in the wall, and subsequently fixed themselves in the ground at its base. Not far from the Water Bastion too, he will see a most curious example of a banyan tree which has seeded itself in the parapet, quite fourteen feet above the ground; from which numerous air roots have run down the whole face of the wall, till they have anchored themselves in a similar way below; and there can be no doubt that in course of time these trees will breech the walls as effectually as was ever done by British cannon, if they are not removed before they have had time to do so.

This destructive faculty of the Bô-tree, is therefore regarded by pious Buddhists as a species of sermon written in stone, preached to man by his Creator. Nowhere does the instability of human greatness receive

a more impressive illustration than in this rapid effacement of the works of man by the agency of exuberant vegetation, under the influence of moisture and the rays of a vertical sun. Damp is said to be the moth of time—while it causes rapid growths, it produces no less rapid decay. In *dry* climates, on the contrary, things practically seem to last for ever, as we find for instance in Egypt, where grains of wheat, enclosed in the sarcophagus of a mummy, have germinated after a sleep of three thousand years; and paintings and gildings, executed upon plaster work, and upon coffin cases, appear as fresh after the lapse of thirty or forty centuries, as if they had been executed but the year before. We have even seen the marks left by workmen's trowels upon stucco-work remaining as if the work had only just been finished. Contrast this with the action of climate under the influence of damp, even so far from the equator as Calcutta (latitude 22° 33′ 47″ N.), not far from the tropic of Cancer, concerning which Sir James Martin, in his day a high authority on medical science in the Indian service, and a careful observer of climatic changes, says—

"A familiar but emphatic illustration of the effect of our climate may be seen in its influence on the habitations of Calcutta. Constructed of the finest materials, and of such solidity that in England they would endure for centuries, they are here, through the destructive alternations of climate alone, rendered in a score of years, or less, fit habitations only for crows; in much less time indeed, they may be seen reduced to a heap of rubbish, covered with vegetation." *

Time and space oblige us in some measure to abbre-

* *The Influence of Tropical Climates in the Production of Disease*, by Surgeon-General Sir James R. Martin, C.B., 2nd edit., p. 57.

viate the veteran physician's interesting and instructive account of these phenomena.

"A deserted village" (he goes on to say) "is overflowed by the forest, like the waves of the sea: in the course of two wet seasons the traces of man are buried by the exuberant productions of Nature; all marks of human labour, industry, and art being obliterated in an incredibly short time. The Peepul tree (or Bô-tree) is the great enemy of buildings. 'No wonder,' says Colonel Sleeman, 'that superstition should have consecrated this tree, delicate and beautiful as it is, to the gods. The palace, the castle, the temple, and the tomb—all those works which man is most proud to raise, to spread and perpetuate his name; crumble to dust beneath her withering grasp. She rises triumphant over them all, in her lofty beauty, bearing high in the air, amidst her light green foliage, fragments of the wreck she has made, to show the nothingness of man's efforts.'" *

The Buddhists have therefore, as we believe, adopted the Bô-tree as a type of the vanity and instability of earthly greatness, which has always been made a prominent doctrine by the teachers of that faith. Thus, Sir Richard Temple, in alluding to this matter, has pointed out that—

"In the more modern of the Buddhist temples, there is a stone figure, seated, or standing, and sometimes colossal, of Buddha. The forefinger solemnly points to warn men to look from mortality to immortality—from the seen things of time, to the unseen things of Eternity. The hand, holding a pinch of dust, indicates the insignificance of all human greatness." †

Nowhere, therefore, could the fable of Gotama Buddha receiving his Buddhahood, have its scene

* *The Influence of Tropical Climates in the Production of Disease*, by Sir J. R. Martin, 1861 p. 57.

† *India in 1880*, by Sir Richard Temple, late Governor of Bombay, and Lieut.-Governor of Bengal, 1881, p. 28.

placed in more fitting surroundings than under this great oriental representative of the vegetable world—whose age in comparison to that of man, appears almost as eternal.

The remarkable size and beauty of the foliage of many of the tropical trees is a feature which can hardly fail to attract the notice of every observer. This is a matter which has only been dealt with in a cursory way by many writers, who are content with the bare assertion of the fact, accompanied, it may be, with one or two examples of prominent cases. We shall, however, venture to go into this somewhat more in detail, while calling attention to certain points which, we think, deserve to be more generally noticed.

We must, however, premise our remarks, in the first place, by calling the reader's attention to the fact that in many cases the foliage of the mature, full-grown tree, is notably smaller in size than that of the young plant or seedling; so much so, that the stranger is sometimes inclined to doubt whether these great trees are the true progenitors of the younger and more vigorously growing seedlings, whose large and handsome leaves excite the admiration of all beholders. A capital instance of this is afforded by our old, and in England now well known friend, the "*Ficus Elastica*" or Asiatic Caoutchouc tree (often erroneously called the "India Rubber tree"), the beauty of whose foliage has caused it to be largely cultivated by the London market gardeners, until there are probably few houses in London which have not at one time or other been adorned by its splendid, dark green, glossy leaves. Yet, in the old tree, in its natural

habitat, these great leaves are replaced by others, certainly not exceeding one fourth of their size. So remarkable is this difference, that at first sight it is not easy to believe that they belong to the same kind of tree.

Now, why is this? The answer we believe to be very simple; and we venture to look upon this as another of those wise provisions of nature to prevent the destruction of the aged monarchs of the forests by storms. It is easy to see, if the great trees were still covered over their whole extent by these large leaves, they would be unable to withstand the fury of the gales, which in the form of cyclones visit at intervals almost every part of the intertropical regions. Kind Nature, therefore, takes the veteran of the forests under her protecting care, and as the cautious seaman does at sea, she shortens sail, by dwarfing the foliage, and shortening the shoots, rendering the latter thicker and more wiry, while each leaf presents a lesser surface for the wind to act upon; but at the same time the foliage sets more closely together upon the shortened shoots, and so increases the umbrageous shelter thrown upon the ground below.

The gigantic leaves seen in the tropics, of which the Banana forms a prominent example, are mostly grown on herbaceous plants, or else upon creepers. The Palmaceæ form, however, notable exceptions to this rule. The largest leaves in the world are probably those of palm trees; but if this be so, Nature takes care to limit their wind-catching effects by only having a few of them growing upon the tree at the same time. As the old leaves mature, they dry off, and fall from the tree, leaving a long clean stem en-

tirely clear of anything that can catch the wind. Then again these great leaves are borne aloft upon stalks of enormous strength, but of such construction that they are capable of bearing a strain of almost any reasonable intensity.

The stems of palm leaves are therefore very generally made use of by natives of tropical countries, as "shouldersticks" for carrying loads, for they are at once light, smooth, and elastic, and the very thing for such a purpose; and men may frequently be seen carrying home a bunch of bananas suspended to each end of such a carrying stick, each of which may weigh forty or fifty pounds. Large bunches may, however, weigh up to seventy pounds, but of course the porterage of such heavy loads is only possible for short distances.

As for the palm tree itself, as the reader is aware, the foliage is generally confined to a mere crown of leaves on top of a bare pole, and after night their lofty heads may be seen uplifted high above the surrounding vegetation, spread forth in the still atmosphere, like a gigantic plume of ostrich feathers. The cocoa-nut palm (*Cocos Nucifera*) may be cited as a good example of this, and well-grown specimens of these trees usually rise 60 or 80 feet to the crown; the diameter of the stem, which rarely exceeds about a foot, being about the same size all the way up, except just after issuing from the ground, where there is generally a protuberance. It is quite a sight to watch these beautiful trees in a heavy gale, with their strong but yielding stems, bending before the fury of the blast, like a well-made fishing-rod; while the crown, caught underneath by the gusts, closes up together, almost

like a lady's fan—and thus this apparently fragile tree is enabled to withstand the deadly effects of very severe storms; though in cyclones of great intensity much damage is, of course, sometimes done to trees of every description, as well as to the most solidly built houses.

Another beautiful example of a very tall, slender trunk hardly larger than a bamboo, which may be seen bearing aloft its graceful feathery crown in safety, even in very heavy gales, is the Areca Palm (*Areca Catechu*). These trees, which are common in the low-lands of Ceylon, form most picturesque objects when seen upon the edges of patches of jungle, where their great height and slender form cannot fail to catch the eye of the passing traveller. They seem to do best in somewhat swampy localities, and the nuts yield several valuable products, among others the "Betel Nut," which is so much used in conjunction with Betel leaf for chewing by natives of oriental countries, and which stains their teeth and saliva like blood.*

There is in fact hardly one of the palm tribe, that does not possess some special feature, either of beauty or utility, which would entitle it to a detailed description, had we time and space to devote to it; but while we must endeavour to be as brief as possible, we must find room for a few words respecting the gigantic size of some palm leaves, those, for instance, of the "*Manicaria Saccifera*" of Para are stated to be "thirty feet long, and four or five feet wide, not pinnate but entire and very rigid. Some of the pinnate leaves are much longer, those of the *Raphia Tadigera* and *Maximiliana*

* The Betel leaf used with this nut must not be confounded with the former, as this leaf is the produce of quite another plant, *viz.*, "Piper Betel" or the Betel Pepper Vine, a species of liana.

Regina being both sometimes more than fifty feet long." *

The fan-shaped leaves of others are ten to twelve feet in diameter; of this last form of leaf, we may cite that of the "*Sabal Umbraculifera*" (*Von Martius*) of the West Indies, as a good example. Its magnificent "shade-giving" leaves form one of the grandest natural fans with which we are acquainted. Quite equal to it is, however, the Talipat palm of Ceylon (*Corypha Umbraculifera*), another splendid specimen of a fan-leafed palm, whose stem is sometimes 100 feet high while its leaves form semicircles sixteen feet in diameter, with an area of nearly 200 square feet each. †

The immense height to which some of the palm stems rise is another matter which it would be wrong to pass over in silence, and on this head we may just remark that Baron Humboldt mentions having measured one of these great palms in South America, which had attained a height of 192 feet. §

Another marvellous feature in the tropical forest (that wonderland, which like the enchanted palace of some fairy tale, is ever teeming with fresh objects of attraction and beauty), is undoubtedly that of the great arborescent grasses. Of these the bamboos of course present the most remarkable examples. Bamboo is a general name commonly applied to a vast number of gigantic grasses, known as the *Bambusaceæ*, of which it is stated that there are some 20 genera and 170

* *Tropical Nature*, by Alfred R. Wallace, 1878, p. 41.

† *Ceylon*, by Sir James Emerson Tennent, Lieut.-Governor of Ceylon, 4th edit., 1860, Vol. i., p. 110.

§ Humboldt's *Travels*.

species * catalogued by botanists. These are of all sizes, some of them being of great height, while others are small and reed-like; they are found ascending to great altitudes on mountain ranges, as for example on the Himalayas in the neighbourhood of Darjeeling, in British Sikkim, where we have seen them growing luxuriantly at a height of at least 8000 to 9000 feet above sea-level. The large-growing varieties vary from 20 to 100 feet or more in height. † These, however, are all habitants of the hot regions of the tropical zone, and the moment we pass out of them the bamboo becomes dwarfed in size, and generally deteriorated in appearance.

Some of the finest kinds of bamboos, in fact, are only found growing over a restricted area of the earth's surface, though they would probably do well on damp, rich soils everywhere throughout the torrid zone. Among the large-growing kinds, the common bamboo (*Bambusa Vulgeria*) is, however, a cosmopolitan species, found throughout the warmer regions of Asia and America, where it sometimes "attains the height of 100 feet or more, with a diameter of one foot at the base;" and like all these plants shoots up with such unconceivable rapidity that it "attains its full height, in a few months." §

In the great Brazilian forests bamboos grow to an enormous size; and Mr. Walsh states that he saw "many two feet in circumference, and so tall as to resemble forest trees;" ** and he mentions his having cut one of the larger varieties about the middle, and

* *Dictionary of Economic Plants*, by John Smith, A.L.S., 1882, Article "Bamboos."

† *Ibid.*

§ *Ibid.*

** Walsh's *Notices of the Brazil*, 1830, Vol. ii., p. 56.

"found it fifteen yards long, where it was not quite so thick as his wrist, so that the whole plant must have been 90 feet, tapering, and polished the whole way with exquisite finish." *

It is probable that in the whole field of tropical vegetation Nature furnishes us with no more attractive or picturesque object than a clump or forest of these gigantic grasses—because *grasses* they distinctly are, and as such we should like the reader to regard them.

If we examine the flower stem of one of our strong growing meadow grasses, we shall find that in its form and structure, it closely resembles that of the bamboo in all essential respects: the bamboo being merely as it were a mammoth reproduction of the other, while both plants mature their stalks in something like the same time.

The young shoots of the bamboo—which at first, by the bye, look somewhat like a species of giant asparagus—are many of them edible, and form a very good vegetable, much used by natives of some tropical countries. These shoots generally first begin to appear soon after the commencement of the rains, and grow so rapidly that they attain their full height by the end of the summer, just like ordinary grass.

Mr. Robert Fortune, formerly botanical collector to the Horticultural Society of London, and the H.E.I.Co., for instance, states with regard to the "Mow-chok," or great Chinese Bamboo, that "he found a healthy plant grew two feet, or two and a half feet, in the twenty-four hours, and most quickly during the night." †

* Walsh's *Notices of the Brazil*, 1830, Vol. ii., p. 56.
† *Residence Among the Chinese*, by Robert Fortune, 1857, p. 190.

This magnificent bamboo Mr. Fortune considers the most beautiful of all the bamboos, and says that, "it grows 60 to 80 feet high, with a long clean stem," and that it is considered of great value in the arts.*

Then again we have the "Giant Bamboo" (*Dendrocalamus Giganteus*), originally a native, we believe, of Malacca—which is said sometimes to attain a height of over a hundred feet, and to be the largest of all known bamboos; it is distinguished from most of the commoner kinds, by the beautiful deep violet-blue metallic colouring of its stem. Magnificent clumps of it may be seen in the Royal Botanic Gardens at Peradeniya, Ceylon, where it was introduced from Penang in 1856. At Peradeniya it is stated that "the culms attain a length of nearly 100 feet and a diameter of nine inches. They appear during the rains of June and July, and grow at the rate of fully one foot in the twenty-four hours, thus soon reaching their full height."†

A clump of these giant bamboos, in these gardens, of which there are several measuring perhaps some twenty yards each in diameter, is a sight to be remembered; the stems (or culms) grow so closely together, that a terrier dog in some places could not pass between them; and when the wind blows, in common with all the great bamboos, a curious crepitating noise is heard, caused by their knocking together, as these lofty poles sway to and fro in the wind. Bamboo clumps all grow after much the same fashion, and resemble each other very much in general character; some have yellow, some green, and a few, dark

* *Residence among the Chinese*, by Robert Fortune, 1857, p. 190.

† *Handbook to the Royal Botanic Gardens, Peradeniya*, by Dr. Trimen: quoted in Ferguson's *Ceylon Directory* for 1890, p. 144.

violet-blue colouring, with a metallic lustre; the culms are mostly smooth, highly polished and tapering, exactly representing the general outline of so many gigantic but well balanced fly rods; in fact, a well-selected bamboo *does* at once supply a ready-made fishing rod of the finest quality.* The heads and stems of all are furnished with long narrow leaves, very much resembling those of the common lake reed at home, though perhaps more delicate in tracery—and bamboos therefore, as we have said, whether in mere clumps, or in forests, always form a beautiful and picturesque object in the landscape.

In the distance, by day, they often resemble some graceful group of weeping willows, planted on the borders of the streams and rivers; and on the sultriest day the most delicious shade is to be found beneath the overarching plumes of these giant arborescent grasses. So thickly and closely do some kinds grow, that the sun can never penetrate through their matted thickets. Unfortunately a few kinds are covered with the most forbidding thorns: we may mention the names of the "*Bambusa Spinosa*" of Eastern Asia, and the "*Bambusa Blumeana*" of Java, as good instances of these latter. But to see bamboos of all kinds at their best, they should be viewed either just before the rising, or after the going down of the sun; we have at such times been again and again struck by their wonderful and exquisite beauty; for so soft and delicate is their tracery, and so graceful their outlines, that during the still majesty of the equatorial night, when the sultry air is at times so perfectly calm that a feather would float perpendicularly down to the ground,

* As regards this see details given in our Section on "*Fishing*."

we have frequently seen large clumps of these giant grasses, standing aloft, motionless in the brilliant moonlight, looking exactly like the spectral forms of some gigantic fern, with overarching fronds, bending towards the earth—their stems rising out of the impenetrable blackness of the shadow cast by them upon the ground beneath.

Tropical vegetation of all kinds, but especially palms and bamboos, are always seen to the best advantage on such occasions; and probably at no other time does Nature present so perfect a picture of complete and dignified repose. During the great heats of the day, the uprising of heated and rarefied atmosphere from the earth's surface generally produces a draught of air that feels more or less refreshing to the jaded senses, and not unfrequently amounts to a pleasant breeze; but except during the prevalence of heavy rain-storms, as soon as the sun goes down, and the heated ground begins to cool, this grateful draught of air is apt to die away, and then these perfectly still moments of which we have spoken, accompany the closing in of darkness, and the gradual appearance of the brightly shining stars whose lustrous glory fills the tropical night with splendour.

There is also generally another short interval of a similar kind, just before and accompanying the dawn, which follows the withdrawal of the nocturnal birds, beasts, and insects, whose sounds at this time become silent, in anticipation of the general awakening of Nature which succeeds the rising of the great luminary of the day. At these times a stillness prevails which may almost be felt: not a leaf is in motion, and the quiescence of Nature is complete.

But unlike the deathlike silence of the snow-clad regions of the north, or that of the desert, or the prairie, this sleep of Nature in the torrid zone is always that of regal splendour, taking its nightly rest surrounded by all the tokens of pomp and magnificence, which the possession of boundless wealth and resources alone can supply.

In taking leave for the present of the subject of the arborescent grasses, we think it well to remind the reader that after producing their seed, the stems of bamboos and of many other kinds of these great grasses, wither and die, * so that a constant succession has to be kept up, either by "suckers" springing from the roots, or by means of seed, more especially in districts where there is a long spell of dry weather; but we shall refer further on more particularly to this matter in connection with the subject of the Jungle. †

No account of the tropical forest could, however, be considered at all complete without some short account being given of the vast multitude of creepers of various kinds, which literally seem to overspread the equatorial forest, as water spreads itself over the surface of flooded lands. Some of the larger and most vigorous species, such as the rattans, seem to have almost unlimited powers of extension. Many of these kinds have epiphytal roots, which attach themselves to trees and

* *Dictionary of Economic Plants*, by John Smith, A.L.S., 1882,—article "Bamboos."

† By some writers on botanical subjects it has been denied that Bamboos can reproduce themselves by suckers arising from the roots after the death of the parent plant, above ground. It can, however, we think, be easily shown that this is a very erroneous view, taken without due consideration of the facts. Like other grasses, though the tops die down, the roots may throw up fresh shoots, and though this is not *common* among bamboos, yet it sometimes occurs.

draw sustenance from the air, and thus flow from stem to stem, and from thicket to thicket, in a way that renders it almost impossible to trace the course of any particular specimen, except by cutting down the trees. Mr. Wallace, however, thinks that in some cases they may be as much as 1000 feet long; and if so they can compete with the giant seaweed of the Southern Ocean (*Macrocystis Pyrifera*) for the distinction of being regarded as the longest of all vegetable growths. It is this class of plants that renders travelling through these forests a work of such labour and difficulty; many of them being armed with tremendous thorns and prickles, whilst others are dreaded by the natives for their acrid juices. The thickets are thus often rendered actually impenetrable until a passage is cut, or tunnelled, through the tangled masses of vegetation. An immense province, in the interior of Brazil, for instance, of which very little has as yet been explored, has thus been called the "Mato Grosso," or the Great Thicket, as these words signify in Portuguese. *

Some idea of the difficulties of forcing a passage through these dense masses of vegetation may be formed from the statement of Mr. H. M. Stanley, who says his rate of progress during his great march through the forest was often under a quarter of a mile per hour: and at a meeting of the Royal Geographical Society, he subsequently explained that the sum of the journeys made by the expedition under his command for the relief of Emin Pasha, extended to upwards of six thousand miles, and occupied 978 days, 500 of which were passed in the forest, through which they actually travelled 1670 miles, which would

* This territory comprises within its limits 668,655 square miles.

give an average progress hardly exceeding $3\frac{1}{3}$ miles per day, without making any deductions for halts and days of rest. *

The lofty trees of the equatorial forest, according to the same authority, frequently attain two hundred feet in height, and not only overshadow the earth with their own thickly interlacing branches and foliage, but also act as natural pillars, which support in addition a truly enormous mass of parasitic vegetation; so that, in many cases, the foliage of the tree itself bears but a small proportion to the vast collection of overgrowing creepers and parasites with which every part of the trunk, limbs, and crown, are often covered.

These creepers and plants are of all sorts and sizes, some of them adhering closely to the standard tree, after the manner of ivy in our own country; whilst others hang from the branches entirely clear of the trunks, and form regular natural cordage, varying in thickness from that of ordinary twine to monstrous growths, which greatly exceed the largest ship's hawser in thickness, and represent enormous twisted cables, as thick as, or thicker than, a man's thigh. A great deal of this mass of cordage descends from great heights, and seems to have no foliage upon it, as far as the eye can reach; it is only where the creeper has ascended out of the gloomy depths of the forest into the brilliant sunshine, which glows with unsurpassed splendour upon the tree-tops, that it spreads itself forth in a mass of tangled verdure, burying everything under a sea of foliage.

These masses of climbing plants are known through-

* See Mr. Stanley's speech at the meeting of the R.G.S. reported in the *Times* of May 6, 1890.

out the tropics under the general name of "*lianas*," but definite information as to their size, length, habits, etc., are matters concerning which almost nothing is known beyond the general fact that they are "creepers," this name embracing a great variety of plants of different sorts and sizes.

Many kinds of these lianas are flowering plants, producing a profusion of the most beautiful flowers; the scent of some of these is delicious, but in other cases they have a rank, and exceedingly disagreeable smell; but fortunately these repulsive varieties appear to be comparatively few in number; many kinds we believe to be odourless, or nearly so. The superb masses of colour, for example, produced by the Bougainvillias, so frequently seen in Egypt and other parts of the East, or the Bignonias, which often entirely cover large trees in the North West provinces of India with a mass of splendid bloom, have very little scent; but the way they grow over walls and trees, in gardens and shrubberies, affords us a good illustration of the manner in which their more gigantic and coarse growing companions, the forest lianas, bury the great trees of the primeval forest beneath their exuberant masses of leaf and flower. When standing on some eminence overlooking the jungle, and beholding some wonderful display of floral beauty, a difficulty therefore often arises in determining whether the floral display is due to the tree, or to creepers growing upon it, and we regret to say that even after a careful examination made with a good field glass one is often unable to determine the question to one's own satisfaction—at least that has been our own experience.

The German traveller Von Martius, whose long

residence in the primeval forests of Brazil makes him quite an authority in these matters, has given a somewhat detailed description of the habits of these singular plants, * and the extraordinary way in which these parasites spread themselves, "like a fluid," over trees and other objects, every now and again sending down "air roots," and thus gaining fresh strength to prolong their already enormous growths; which like the interlacing cordage of a line-of-battle ship of the olden day bind the trunks of adjacent trees so securely together that the most violent storms are unable to tear them asunder. "Large flowers of remarkably brilliant colours are also, as we have said, characteristic of the lianas or climbing plants," but as these are generally "spread over the very tops of the highest trees, very often a fallen flower, or a peculiar odour, is all that betrays the presence of these rare beauties, to which the botanist often looks up in vain." † Brilliantly coloured flowers, as a rule, we may here remark, almost invariably seek the brightest sunshine. Hence it comes that we often hear of superficial observers jumping to the conclusion, either that there are no flowers at all in these forests, or complaining that the floral treasures are seldom to be seen. Occasionally, however, when circumstances admit of a good bird's-eye view being obtained over the summits of the tree-tops, the observer becomes suddenly convinced of his error. The author, for instance, can never forget the extraordinary magnificence of the floral

* See, *Reise nach Brasilien*, by Von Martius, Vol. iii, p. 32, etc.

† *Outlines of the Geography of Plants*, by F. J. F. Meyen, M.D., Professor of Botany at the University of Berlin, p. 164. (Translated from the German for the Ray Society of London, by Marg. Johnston, 1846).

display which he witnessed on one occasion from the summit of a rocky eminence, in the neighbourhood where the works upon the great canal across the isthmus of Panama have since been carried on; the whole country, at that time, seemed to be overspread with a gorgeous carpet of flowers. The extraordinary size of some of the flowers that have from time to time been discovered in these situations is no less remarkable than their brilliancy. For instance Professor Meyen states that—

"the flowers of the *Aristolochiæ* are famous for their extraordinary size; on the shady banks of the Magdalena, in South America, Humboldt discovered *Aristolochia-Cordifolia*, the flowers of which are four feet in circumference, and are often worn in play, as caps, by the Indian boys; and the *A. gigantea* of Von Martius has flowers almost a foot long." *

Another class of plants distinguished for the occasional beauty and richness of their flowers are of course the Orchids, most of which grow on the bark of trees. "These flowers," says Humboldt, "sometimes resemble winged insects, sometimes birds which the perfume of the honey has allured. The life of a painter" (he says) "would not be long enough to delineate all the magnificent *Orchideæ* which adorn the mountain valleys of the Peruvian Andes."† So far as our own observation, however, has extended, comparatively few of the orchids have beautiful flowers; most of their flowers are small and curious, but inconspicuous; and one may travel a long way through the forest without coming upon anything very striking of this kind.

Most of their flowers, too, are scentless; some few,

* *Outlines of the Geography of Plants*, by F. J. F. Meyen, M.D., p. 166.
† *Ibid.*, p. 155.

however, have a delicious aroma. When this is so, their fragrance is usually of a very delicate and refined nature. Among the vegetable treasures, for example, obtained from plants of orchidaceous growth, we may mention the now well-known Vanilla (*Vanilla Planti-folia*), which produces the deliciously scented and flavoured vanilla beans, one or two of which, enclosed in a trunk, among clothes, will in a hot climate in a short time impart its aroma to every article packed within it. Now vanilla is a species of fleshy orchidaceous creeper, originally a habitant of the forests of Brazil, where it was discovered by Plumier in 1703. It is a strictly shade-loving plant, very tough in its texture, but with nothing very remarkable about it in appearance. Yet, as we know, this humble and unobtrusive looking plant has already cut a considerable figure in the world, and is now largely cultivated in many tropical countries, as its value as a commercial product of the great forest region of the equatorial zone seems to be constantly more and more appreciated.

But besides the exquisite beauty of many of the floral treasures of these regions, the tropical forest possesses still another, if possible yet more delicate and beautiful form of colouring, which may be regarded as quite peculiar to itself, in its numerous varieties of "foliage plants," as they are now called by horticulturists. The singular grace and delicacy of colouring displayed by the leaves of many of these plants are well known; and a fairly good idea of the splendid effects that they are capable of producing, in the way of artistic decoration, may be obtained by the inspection of a good stove-house at home, whose still and sultry atmosphere gives an exact artificial representation of

that of the natural habitats where most of these plants luxuriate in a state of nature. Some of these, as the intelligent reader is doubtless aware, are sun-loving plants. No sun can be too hot, or too bright, for some of them—the crotons, for instance.* Others are altogether of a shade-loving nature, and though the high temperature of the torrid zone is essential to their existence, yet a short exposure to the rays of a vertical sun would speedily terminate their frail existence, or at all events would shrivel up and destroy the matchless grace and beauty of their delicate leaves, like the breath of a furnace. It is these, and such like gems, therefore, that flourish in the shady nooks, and everglades, which exist in abundance beneath the thick canopy of overarching foliage, concerning which we have already striven to convey some faint idea to those readers who have honoured us with their attention.

This canopy, as we have said, is evergreen: throughout the year it varies but little either in appearance or density. There is no fall of the leaves in these regions—properly so speaking, corresponding with that of our autumn and winter—leaves are always falling, however; but are also almost always budding. In the tropical forests, therefore, we lose the autumn tints, so much and so justly admired at home, but in their place, as we shall presently show, the dwellers in the torrid zone are fully compensated for the loss by the exquisite brilliancy and beauty of colouring displayed by the young leaves and shoots of many of their trees.

This is a subject which, as we venture to think, is

* Around Colombo, Ceylon, every cottage garden is adorned with superb specimens of these plants. All the best varieties of Crotons do well there and form regular trees, almost as large as lilacs at home.

generally overlooked in books, and by writers in their descriptions of the tropical landscape: perhaps because in many cases it is mistaken for that of flowers—for these young growths have all the effects which can be produced by the finest display of floral magnificence, their tints including nearly every hue and colour commonly met with in tropical flowers. The young leaves and shoots, for instance, will represent the most brilliant reds, scarlets, claret-colours, purples, browns, and yellows, of every conceivable shade—as well as the most perfect and delicate shades of white—so that, at a distance, they have all the effects of beautiful flowers.

These brilliantly coloured growths, moreover, often cover the entire surface of groups of gigantic trees, forming the natural growths of the jungles and primeval forests of the equatorial zone. You may, with a good glass, see them almost everywhere; and nothing can be more beautiful and more striking than the effects which are often produced by them.

And here, perhaps, we may take the opportunity of pointing out the capital importance for the observant traveller, of being possessed of a good glass. This is a matter which we have not failed to insist upon in another portion of this work, which treats more particularly of these subjects, and gives some technical details respecting them, to which we beg to refer the reader. Without a good glass, we venture to think that the explorer of tropical forests is *nowhere*. The altitude, and inaccessible position of some of the trees, is so great and so frequent, that there is very often no other available means of examining the details of the distant landscape, or even of individual trees, except by means of a glass; and with a really good

glass, at a distance of one or two miles, all the leading features ought to be thoroughly discernible.

We are quite aware that a hasty and superficial observer may object, with some apparent show of reason, that the dense nature of the jungles, in these regions, would render the use of a glass, according to his idea, a matter of impossibility—and we do not deny that in many places this is so. But in all great forests we venture to point out there are lofty ridges, rocky crests, windfalls, and barren spots, where occasional gaps occur in the thicket; as well as numerous streams and rivers and paths, wherever there are inhabitants, traversing the primeval forest in every direction. Even the great forests of the Upper Congo, brought into notice by Mr. Stanley, form no exception to this rule. And from these positions distant views of the forest, if they are carefully looked for, may frequently be obtained, especially where the country is of a broken nature, or where there are ravines or mountains. The views up and down ravines, or along the course of rivers, streams, and dry watercourses, are often of the most striking character imaginable, opening up vistas of extraordinary beauty from whence all the hidden glories of the great wilderness of verdure may frequently be inspected, and valuable details of a technical nature taken note of, by a careful and intelligent observer, in a way that will often be surprising, even to himself. Nothing can be done, comparatively speaking, from such places without the aid of a good glass, but by its assistance numerous details entirely hidden to the naked eye become at once perfectly apparent.

As regards the means of communication through these great forests, which are generally represented as

being trackless, it may perhaps be desirable to mention, that pretty well all known forests are inhabited by scattered bands of natives, who inhabit their inmost recesses, and who can, if so disposed, almost always conduct strangers through any part of them, by means of local paths used by the jungle people, and known only to them. *

The celebrated Red Indian warrior tribes, who used to inhabit the immense forests of North America, furnish a well-known and admirable instance in point—but nowhere perhaps can we, at the present time, find people possessing larger or more varied experience in such matters, than among British officers in the Indian service. There, there is a regular, organized forest service, for the inspection and conservancy of the great tropical forests, that cover large areas in our Indian empire—and we believe that these remarks convey in brief, what has been the general practical result of their experience.

This is a matter which, from a military point of view, has frequently assumed an aspect of extreme importance in the history of British colonization; for the difficulty of effectually dealing with these wild tribes has frequently proved to be very great. This fact has been clearly pointed out, in a recent work, by a well-known American writer, in connection with the settlement of his own country, for he says—

"Much has been written and sung of the advantages possessed by the mountaineer, when striving for his home against invaders from the plains; but these advantages are as nothing

* See, *Hints on Mountain and Jungle Warfare*, by Lieut.-Colonel J. C. Gawler, 1873.

when weighed with those which make the warlike dweller in forests unconquerable, by men who have not his training. A hardy soldier accustomed only to war in the open, will become a good cragsman in fewer weeks than it will take him years to learn to be so much as a fair woodsman, for it is beyond all comparison more difficult to attain proficiency in woodcraft, than in mountaineering." *

Before closing this section, we think it desirable to add a few words upon the subject of tropical fruits, and upon one or two of the other rarer and more valuable treasures of the great forest region. The number of different kinds of fruit peculiar to the tropics is, however, very large, and it would of course be impossible to attempt anything like a detailed statement respecting them.

Moreover, the flavour of many of these fruits is not much esteemed by European palates; it is alleged that they are mostly too sweet and luscious and too highly scented, or else have a rough and unpleasantly tart or astringent taste. There can be no doubt that there is a good deal of truth in these assertions, and that in general popularity and exquisite flavour, they can hardly be said to come up to the best fruits of the temperate zones; thus in the tropics, they have probably no fruit to match a really first-rate peach, † nor any that will bear comparison with the strawberry, or perhaps with a first-rate pear, nor yet with the orange. Both the peach and the orange, however, have been grown in certain tropical stations, and the latter will often bear remarkably well, yet the

* *The Winning of the West*, by Theodore Roosevelt, 1889, Vol. i., p. 79.

† The peach is indigenous to Persia, and is strictly speaking a habitant of the desert zone.

flavour of the tropical grown orange cannot compare with that of the best oranges grown at places within the warmer regions of the temperate zone, as for instance at St. Michael's, or in Morocco, Tripoli, and other places in Northern Africa, and in some parts of Asia Minor; grown in hot districts, such as Ceylon, for instance, the orange becomes evergreen, the fruit is green even when perfectly ripe, but its excellence is gone, and it is an acrid and degenerate member of a noble family of fruits.

On the other hand, there are many undoubtedly delicious fruits of tropical origin. Of these we may take the pineapple (*Ananas Sativa*) as a leading example. Now this splendid fruit is strictly a habitant of the very hottest and dampest regions of the equatorial zone. There only, beneath the incandescent rays of a vertical sun, will it flourish in its best and highest flavoured form—though it will, as we know, grow in drier localities, where a less high and equable temperature is found; but if so it proves of indifferent flavour, and it is to this that we attribute the low estimate which the pineapple appears to possess in the opinion of London gourmands. With the exception of a few stove-house pines, grown at great expense, very little good fruit of this kind ever appear in the London market. To know what the pineapple is, when grown in perfection, one should taste one grown in the hot regions of Brazil, where certainly the finest pines we have ever eaten were produced. Very few good pineapples are grown in Ceylon and other parts of our tropical possessions in the East, because the varieties there cultivated are many of them of an inferior and even worthless description. A radical change in these matters

would be most desirable. The fault is with the grower.

As good typical examples of tropical fruits, of a soft and luscious character, the custard apple, the papaw, the banana, and the mangosteen, may be selected. It is this class of fruits which are accused of quickly cloying upon the palate, and after a few days' trial becoming positively distasteful to many people. They are further objected to by some persons as being very unwholesome. All that we shall venture to say in their defence is that these supposed failings greatly depend on whether or not they are eaten exactly at the proper moment: especially the three first named examples.

None of this class of fruits keep well: when ripe they require to be eaten at once, or they are completely spoiled. If they are the least overripe, a species of vinous fermentation immediately sets up in them, which quickly destroys their delicate flavour, and renders them, to most European palates, positively nasty; while at the same time, there can be no doubt, they become in many cases exceedingly unwholesome—in that of the banana especially.

This last fruit is, as we know, a regular article of food with vast numbers of natives inhabiting tropical countries—and it is possible to live upon it exclusively, for long periods of time, without experiencing any evil effects. What would have become of Mr. Stanley's expedition, for instance, without the banana?

Really good bananas, in first-rate condition, are, we venture to think, as delicious and harmless a fruit as it is possible to find; which can be partaken of as largely, and eaten as frequently, as almost any fruit we could name, subject to the conditions indicated

above. First-rate bananas, however, are strictly a production of the torrid zones; and if grown in semi-tropical countries, and cut in an unripe green state (for carriage to the London market for instance), cannot be expected to prove fair examples of the banana such as are grown to perfection at places like Colombo, Batavia, Madras, or other warm and equable tropical stations. At Bombay a large variety of the banana, with a deep-red rind, is to be met with, worth taking note of as a special variety of this fruit; but it cannot, we think, bear comparison as to excellence with the smaller, yellow varieties, grown within the equatorial zone: the smaller fruits (short and thick in shape) being, as far as our experience goes, in general superior to those of a larger, and usually coarser, growth.

At the same time, long continued efforts at acclimatization have been so far successful, that the banana has been transplanted from its natural habitat, the equatorial zone, to colder regions, far beyond even the limits of the tropics. Bananas, for instance, are found growing all over the North Western provinces in India; and we have even seen them growing in cold elevated stations like Darjeeling, in Sikkim, and far to the north in places like Peshawar, on the northern frontier of the Punjab. It is sufficient, however, to note the fact of their existing there—their fruit of course, even in the North Western provinces, being to our mind so inferior as to be almost uneatable.

The great leaves of the banana tribe are, as most people are now aware, among the most wonderful and beautiful examples of tropical foliage. Like the bamboo, the banana is perhaps seen at its best by twilight, and standing aloft, motionless in the still glory of the

tropical night, on such occasions these great leaves have always struck us as objects full of grandeur and sublimity, and we specially commend the study of fine groups of these beautiful plants to the notice of future travellers, and artists.

The most superb leaf of this kind is probably that of the *Musa Ensete*, or Wild Abyssinian Banana, now-a-days a common ornament of our plant houses.* The natural habitat of this plant is in the open glades of the jungles of the Abyssinian highlands, where single leaves have been found to measure thirteen or fourteen feet in length, by three in breadth; their singular beauty, and freshness of colouring, set off by a central rib of brilliant red, will doubtless be familiar to horticulturists; its fruit, however, is hardly edible; it is therefore not one of the species which are cultivated for food, such as the well-known *Musa Sapientum*, or the larger or "plantain" species, the *M. Paradisiaca*.

Another most striking example of a fruit tree whose beautiful leaves cannot fail to attract the notice of travellers in equatorial stations, wherever it is grown, is that of the curious, and as yet comparatively little known Bread Fruit tree (*Artocarpus Incisa*), the finely cut, and highly ornamental foliage of which instantly catches the eye, and forms a splendid contrast to the foliage of groups of other trees seen growing in the surrounding landscape. This great tree is an importation from the South Sea Islands, where it was first described, we believe, by the great circumnavigator Captain Cook, a little more than a century ago. Its fruit, which is about the size of a child's head, when properly cooked makes a very

* This species is now so far acclimatized as to do well in the open air during summer in Great Britain and throughout Central Europe.

nice dish with a delicate flavour, not unlike that of rather underbaked fresh bread, much liked by many people. There are several wild varieties of this fruit, which form noble, and large growing timber, in some tropical forests, as for instance in Ceylon, all of them distinguished by their ornamental foliage. The Jack Fruit tree (*A. Integrifolia*) is a good example of these wild kinds; but its fruit is not edible by Europeans. It is used, however, by Natives as an ingredient in their curries. The Mango (*Mangifera Indica*) is another grand and beautiful tree, growing to a very large size, met with in these regions, whose fruit is highly esteemed for the particular richness of its aroma and flavour, and of which there are many varieties. Its splendid dark evergreen crown of foliage forms so dense a canopy that the deep cool shade cast around its trunk is most grateful to the wayfarer in the hot season. These trees are grown in millions all over Hindustan and during their flowering season the whole air is sometimes deliciously scented with the fragrance of their blooms. But we might go on almost *ad infinitum*, to record, did time and space permit, instance after instance of remarkable examples of the vegetable wealth of these favoured regions; we must, however, limit ourselves, before taking leave of this subject, to the consideration of but one further point, which we think ought by no means to be passed over unnoticed. We allude to the delicious freshness, and intense coldness, which visitors to the tropics can hardly fail to have remarked, is characteristic of freshly gathered fruit.

Were fruits growing in hot countries to become heated to the same temperature as that of the atmosphere,

it is evident that one of their most agreeable qualities would be gone. Yet, as we know, many of these fruits only attain their full perfection, when exposed throughout the day to the scorching rays of a vertical sun. To what therefore are we to attribute this curious and beneficent peculiarity?—A Water Melon (*Cucurbita Citrullus*, or Red-fleshed water melon) for instance, growing in a river bed, upon an expanse of sand, from which the waters have retired, if eaten immediately after being severed from the plant, will appear almost as cold as if iced—and yet the sand upon which it rested, may have become so superheated by the sun, that it will burn the naked hand if it comes in contact with it. It will be found that this characteristic in various degrees, is more or less common to every species of fruit.

This is surely a most remarkable and surprising fact, by which we have all, from time to time, profited; but while experiencing a grateful sense of its pleasant refreshment, it has very likely occurred to but few of us to ask ourselves, Why is it so?—yet few natural phenomena are more curious, or better deserving of our attention, than this marvellous power of plants of maintaining and adjusting their own temperatures.

In cold climates, for example, it has been found that the temperature of vegetables is usually somewhat higher than that of the atmosphere; but in hot climates it is maintained at a point considerably below it; and although the causes of this singular faculty appear to be as yet somewhat imperfectly understood, it seems probable that the coolness of fruits is simply the result of evaporation, consequent upon the power possessed by the roots of plants, of constantly attracting

fresh supplies of moisture from the soil. That such is the case, is made evident by the fact that fruit severed from the stalk quickly loses a great deal of its delicious coolness, consequent upon the cutting off of this, its source of supply. Sir James Emerson Tennent, some time Lieutenant-Governor of Ceylon, in his fine work upon this island, has been one of the few who has called attention to this subject; and he is careful to point out that: "even an interval of a few minutes after it has been pulled, is sufficient to destroy the charm; for once severed from the stem, it rapidly acquires the hot temperature of the surrounding air." *

It is therefore (though we regard this statement as to a certain extent, overdrawn) necessary that fruit should be eaten the moment it has been gathered, in order to enjoy to perfection the full benefit of its icy coldness. "Under a blazing sun," the same authority justly remarks, "no more exquisite physical enjoyment can be imagined, than the chill and fragrant flesh of the pineapple, or the abundant juice of the mango, which when freshly pulled, feels as cool as iced water." †

The extent to which evaporation can reduce the temperature of vegetables below that of the air, is well illustrated by some experiments made by Dr. Hooker in the valley of the Ganges; who found that the fresh juice of the Mudar (*Calotropis*) was only 72° F., while the damp sand, on the bed of the river, where it grew, was from 94° to 104° F. § Dry sand

* *Ceylon*, by Sir James Emerson Tennent, K.C.S., 1859, Vol. i, p. 120.

† *Ibid.*, p. 120.

§ *Ibid.*, p. 122.

would, however, probably show a very much higher temperature. Yet cool fruits will grow on what is practically dry and super-heated sand and *do so* in the desert zone.

On the other hand, the increased temperatures maintained by plants above that of the atmosphere, during the bitter chill of a winter's night, in cold climates, seems to be due to their power of closing their pores at night, under the influence of great cold: thus mechanically arresting the process of evaporation, by which their juices would be cooled. All this, however, opens up a very large and very wonderful branch of enquiry, into which it would be impossible for us to enter, further than to remark that it seems to be a species of counterpart to the faculty possessed by animals, of maintaining the temperature of their bodies at their normal point, or nearly so, under the most extreme variations of climate. This in the case of the human subject is ascertained to be slightly over $98\frac{1}{4}^{0}$ Fahr., and it is impossible for it to vary more than two or three degrees either way for more than a very brief period of time without serious disturbance of the general health, and danger, especially in the case of a lowered temperature, even to life itself. Excessive temperatures are, as we know, kept down, and reduced, by increased transpiration, just as in the case of fruits, which we have been here considering; so again, a diminished action of the skin is one of the effects of cold upon the human frame, exactly as it is in the case of trees and plants.

The more we examine this subject, in fact, the more we shall find how closely many of the most important functions of plants and animals are allied to each other.

In this brief sketch of a great subject, there are of necessity a vast number of important products of the equatorial zone, which we have been obliged to pass over unnoticed. Some of these are valuable as supplying various kinds of nutritious foods. In this category, we need only enumerate the beautiful cacao tree (*Theobroma Cacao*) from which cocoa, and its various preparations, such as chocolate, are obtained.

Then there are the sago palms, of which there are several species yielding this useful commodity. Also the different kinds of cassava, which produce tapioca: and arrowroot, prepared from the root of the *Maranta Arundinacea*, and we believe, from other varieties of this species of plants; also in Queensland, it is largely produced from the *Canna Edulis*.

There are, moreover, quite a long list of trees and plants yielding various important commercial products of the torrid zone: as producers of many kinds of timber and cabinet woods; valuable oils, gums, and spices; tanning barks, dye stuffs, etc., etc.—and last but not least, medicinal plants and drugs. We feel that this section would be chargeable with a grave omission, if we were to close it without a notice of a single example of the latter, which out of the medicinal treasures of these great forests, has conferred priceless benefits upon humanity: we refer to the well-known medicine *quinine*, an alkaloid extracted, as we are all aware, from the bark of the Cinchona tree; according to Bentham and Hooker, thirty-six species of this tree have been discovered, but not more than a dozen of them have been utilized.* All

* *Encycl. Brit.*, Vol. v, p. 781.

are natives of the forests covering the mountainous regions of South America, where their geographical range extends from Lat. 10° N. to Lat. 22° 30′ S., and where they are generally found growing on the eastern slopes of the Cordilleras in the province or region known among the Spanish-speaking people as "La Montaña," at an elevation of from 5000 to 8000 feet above sea-level. * It does not do well in the lowlands.

The officinal barks of the British Pharmacopeia are, however, only three in number, which, not to be too technical, we shall describe as "pale," "yellow," and "red" barks. † The most valuable of these is the yellow bark of the *Cinchona Calisaya*, a lovely tree, which grows to the height of some sixty feet, and is said occasionally to obtain a diameter of five feet. § It is covered with rich, dark green, shining leaves, with crimson veins, and produces bunches of white flowers, emitting a delicious aromatic fragrance, in some respects slightly recalling the smell of a freshly made infusion of the bark.

Mr. Clements Markham, who superintended the collection of cinchona plants and seeds in South America, and their introduction into India in 1860, considers this valuable tree "by far the most beautiful of these forests" **—and he gives a most interesting account of the wasteful way in which the bark was then collected by the native "cascarilleros," from the heart of the virgin

* *Encycl. Brit.*, Vol. v, p. 781.

† *British Pharmacopeia*, p. 18, Article "*Cinchona*."

§ Stanford's *Compendium of Geography and Travel for Central and South America*, edited by H. W. Bates, p. 332.

** *Travels in Peru and India*, while superintending the Collection of Cinchona plants, etc., by Clements R. Markham, 1862, p. 270.

forests, where the wood-knife had to be used to clear the path, at every step. He goes on to recount the difficulties that were thrown in his way by the opposition of the Peruvian authorities; who, regardless of everything save their own petty interests, were desirous of preserving the monopoly of this valuable trade; while at the same time no attempts whatever were made to prevent the destruction of these forests, whose extinction had become merely a question of time. The letter of the Alcalde, ordering Mr. Markham's arrest, and the destruction of his collections, is given *in extenso* in his book, in the original Spanish, together with an English translation, and will probably stand forth to all time as a monument of human folly, rapacity, and narrow-mindedness. We wish we had space to reproduce it here, but we must hasten to draw our remarks on this subject to a close, after adding our humble meed of praise to the young French chemists to whom (in 1820) we owe the discovery of quinine, which has ever since proved of such enormous importance in the treatment of malarial fever and other forms of disease. It would be impossible to calculate with any approach to accuracy, the number of lives that have already been saved by it—but the figure must be something enormous: and it is not too much to say that the modern exploration and opening up of Africa could not, in all probability, have been effected, or even attempted at all, without it; it is also very questionable whether the British Empire in India could have been maintained, extended, or brought to its present flourishing condition, without quinine: that it could not have been done without enormous losses and suffering, is practically certain.

We are therefore happy to be able to feel that owing to the exertions of Mr. Markham, and others, the extinction of the Cinchona forests is now placed beyond the reach of practical possibility, and that every year the culture of Cinchona is extending in India, and elsewhere. In many parts of India, for instance, numerous flourishing plantations already exist—trees in the Neilgherry Hills having already attained a height of from twenty to thirty feet.* While in Ceylon, where large quantities of Cinchona trees have been planted upon the highlands of the interior, we have been given to understand that the production of bark is now so large, and the price of quinine so much reduced, that its cultivation is no longer remunerative. This we believe is partly due to the fact that the Ceylon cinchona does not contain so large a percentage of quinine as the Indian trees. At any rate the cultivation of this beautiful tree, as we regretted to observe during our recent visit to that island, is now comparatively neglected, though it grows so freely that we have frequently noticed the seedling trees propagating themselves, wild, upon portions of disused or uncultivated land.

The medical virtues of Cinchona, formerly known as "Jesuit's bark," have been known from an early period in American history, but the first authentic instance of its medicinal use by Europeans dates from 1638. It was, however, not until 1820 that its valuable alkaloid "Sulphate of Quinine" was discovered by two young French chemists, Pierre Joseph Pelletier and Joseph Bienaimé Caventou, in the course of some researches they were making into the subject of the

* *Encyclop. Brit.* Vol. v, pp. 781—2.

vegetable alkaloids. It may be that they did not at first realize the priceless nature of the boon that they were about to confer upon suffering humanity, but however that may be, we feel it our duty to recall to public recollection a circumstance which the world would be ungrateful ever to forget, namely that these young Frenchmen at once placed their discovery at the service of the public, without any restrictions,* instead of keeping it secret, so as to turn it to their own personal advantage, as so many have done when they have made valuable discoveries.

This noble conduct is therefore deserving of more than a mere passing mention, as we fear little was ever done to mark the public appreciation due to their services, as it was not till 1837 that a paltry sum of 10,000 francs (£400) was awarded to them, and ordered seventeen years afterwards to be divided between them.† And so far as we have been able to discover—that was all. We can therefore readily conceive the cynical man of the world exclaiming as he reads these lines—"That shows what fools they were not to keep the thing secret and make a fortune out of it." Yet public apathy, for the last seventy years, goes far in this case to justify these mercenary sentiments. For was not the gift to humanity above all price?

How many of the rising generation, for instance, have ever heard of Pelletier or Caventou? How many of the thousands whose lives have been saved by quinine have felt gratitude to their memory?—Had

* See *Dictionnaire Universel des Contemporains*, par G. Vapereau, 4th edit., 1870 (Article "*Caventou*").

† *Grand Dictionnaire Universel du XIX Siècle*, par Pierre Larrousse, Paris, 1874, Vol. xiii, p. 528.

these men been great warriors, and had each of them slain his tens of thousands—everybody would have heard of them. It would then have appeared ignorant not to know such illustrious names. But as each has merely *saved* his tens of thousands of human lives—the world has forgotten them! and few, very few, are aware that such humble individuals have ever existed. Their names, we might almost say, have passed with their spirits, to that land where all things are forgotten. On the other hand many a statue has been raised to commemorate the supposed virtues of men whose names deserved far less than theirs to live for ever in the grateful remembrance, not merely of every Frenchman, but of mankind in general. *

* We have made inquiries into this matter, and have been informed that there is a bust of Pelletier in existence in Paris, but we understand that unfortunately there is no memorial of Caventou.

CHAPTER VI.

THE GREAT BUSH REGION, OR JUNGLE COUNTRY.

Its Position and Extent. Gradual Change from Damp to Dry Climate. Disappearance of Evergreen Forest. Appearance of Deciduous Trees. High Solar Day Temperatures. Equatorial Climates Contrasted with Those of the Bush Region. The Hot Season not the Unhealthy Season. The Rains as a Cause of Sickness. Jungle Fever. Bursting of the Monsoon. Wondrous Changes Produced by the Rains. Tropical Harvests. The Cool Season. The Hot Season. Sun-Dried Earth. The Tropical Night. The Tropical Sun. Phenomenal Temperatures Mostly Occur Outside the Tropics. Tropical Clothing. Danger of Incautious Exposure to the Sun. Immunity of Persons in Active Exercise. Heat Apoplexy. Alcohol and Sun-Stroke. General Immunity of Sportsmen during Indian Hot Summer. And of European Troops on the March during the Indian Mutiny. Disease and Stationary Camps. Divisions of the Bush Country. The Heavy Forests. The Indian Teak Tree. Fall of the Leaf Caused by Heat, instead of Cold. The Sâl Forest. Central American Mahogany Forests. Ruins and Forest Growths. The Trade Winds. Effect of Mountain Ranges on Climate. The Jungle or Dwarf Forest. Grass Jungles. A Great Indian Grass Tangle. Jungle Belt at Foothills of Mountains. The Indian "Terai." Its Deadly Climate. "El Tablazo" of Peru. Causes of Malaria. Jungles Near Mountains. Malaria Germs and Water. The Arborescent Grasses. Bamboos. "Elephant Grass." Scented Grasses. Central African Grass Jungles. Egyptian Papyrus Reed. Indian Sola Reed. Pith Helmets. Sola Shikar Hats. The Saccharineæ. Sugar Plantations. Rattans and Other Thorny Creepers. Tropical Grasses and Those of the Temperate Zone Contrasted. The Park-Like Region of the Bush Country. General Characteristics of the Dwarf Bush. Grasses of the Bushy Plains in the Dry Season. The Thorny Bush. Thorns and Drought. Acacia Gums. Frosted Gums and Enchanted Gardens. Arab Genii. Grass Fires. Their Effect on Tree Life. Acacia Foliage and Bark. Tanning Barks. Scented Acacia Blooms. Acacia Timber Trees. Overpowering Fragrance of Mimosa Blooms. The Sleep of Plants. Linnæus on the Sleep of Plants. Sensitive Plants. The Sleep of Plants may be Artificially Produced. Baobab Trees. Their Immense Antiquity. Medicinal Virtues of the Baobab. The Baobab as an Exotic. Great Tamarind Trees. Pilgrims Resting Beneath an Aged Tree. The Scriptures on a Great Tree. Great Trees on the Indian Plains. The Red Cotton Tree. The Indian Peepul Tree. The Peepul as a Parricide and Destroyer of Buildings.

The Waterless Districts of the Bush Region. The Kalahari Desert. Stock Farms on Dry Plains. Succulent Qualities of the Bush. Oxen and Thirst. Tree Vegetation Indicative of Water. Instances of Deeply Penetrating Roots. Desert Pools Discovered by the Trails of Game. Pasture Grasses in Waterless Districts. Their Nutritious Quality. Australian Experiences. Cattle as Improvers of the Soil. Fat Game in Waterless Districts. Animals which do not Require Water if Herbage is Succulent. Water-loving Animals. Herds of Game Driven by Thirst. Singing-Birds and Water. Flights of Birds towards Water. Gordon Cumming's Expedition Saved by Watching Them. Importance to Travellers of Observing Habits of Birds, etc. Grasses Indicating Absence of Water. Great Herds of Game and Scanty Vegetation. Protective Colourings of Animals. Motionless Elephants. The Striped Form of Protective Colourings. Sand Colourings. Albinism or Snow Colourings. The Effects of the Colourings of Landscapes on Human Inhabitants. Man's Attachment to the Land of His Birth. The Great African Antelopes. Their Peculiarities of Build. Giraffes. Their Resemblance to Ancient Trees. Antelopes and Deer. Immense Antiquity of some African Mammalia. Causes of the Extinction of Races. The Mammoth and the Mastodon. "Geological Time." The Fossil Man. Vast Numbers of Extinct Forms of Life. The Huttonian Theory. Antiquity of Plant Life. Of Insects, etc. Slowness of Changes in Vegetation.

WE next come to consider the second of the terrestrial zones, into which Nature seems to have divided the earth, which, for reasons we shall proceed to point out, we have designated "The Great Bush Country," or in other words, "The Jungle Region." It comprises two belts: one on each side of the equator, located on the northern and southern boundaries of the equatorial zone; which extend from the 15th to the 25th parallels of north and south latitude, respectively. Each of these regions will therefore represent a section of the earth's surface, 600 geographical miles in width.

The Great Bush Country, as its name denotes, is so called because its prevailing feature is that of a dwarf description of forest, consisting in great part of deciduous trees, which take the place of the heavy equa-

torial evergreen tree growth, near the point where the cessation of the double rainy seasons occurs.

The reader will doubtless remember that in our first, or Equatorial Zone, the climate at the equator consists practically of but a single season, where high moist temperatures combined with rains prevail more or less throughout the year: while some five or six degrees to the north and south of it, these continual rains gradually become modified into *two* seasons of regular rains, with two intermediate ones of dry weather, but the same moist atmosphere still continuously prevails. We have not, however, thought it desirable, on this account, to sub-divide our "Great Equatorial Forest Zone" into two distinct divisions, corresponding with these differences of climate, for several reasons: but principally because the changes in the vegetation do not seem to be so sufficiently marked as to render such a course desirable; and next because of the difficulty of fixing a boundary line where the perpetual rains begin to intermit.

The Great Bush Region, however, we shall venture to define as a region marked by the cessation of the evergreen forest as the leading type of vegetation; and as the approximate boundary of the country where deciduous trees begin to assume a prominent feature in the landscape. Here also, the region of double rainy seasons comes to an end with the equatorial zone; and at about the 15th parallels of latitude we enter a region of single rainy seasons, where the year is divided into one long period of rains, and another of continuous dry weather. Then, as the traveller journeys across the Bush Region, away from the equator, towards the poles, the period of the rains

gradually becomes curtailed until at length we enter our next division, the Desert Zone, where there are no regular rains. It must be clearly understood, however, that in venturing to assign these apparent boundaries to the tropical rains, we merely indicate their approximate limits. Moreover, wherever special circumstances occur to favour it, great stretches of heavy forest, thoroughly equatorial in their character, run up, often for long distances, into the Bush Country; as for instance where rivers of considerable size pass through it, margined by alluvial plains, or where a damp and fertile soil promotes the growth of heavy timber.

On the other hand, wherever disturbing causes interfere with the equatorial rains, and cause a dry district to occur within the region of constant rains, the bush extends itself into the equatorial zone, instead of the heavy forest. We shall presently proceed to point out examples of both these exceptional conditions, likewise other instances on the opposite side of the Bush Region, where the desert extends itself across the boundaries where tree growth might be expected to occur.

Now these differences in the vegetation are merely indicative of climatic peculiarities, the causes of which require to be investigated and understood before they can be accounted for. Notwithstanding these occasional exceptions, however, if we take the map of the world, and study the physical geography of the countries which extend round the earth's terrestrial surface, within the limits which we have indicated as those of the Bush Country—it will be found that *in the main* their character closely corresponds with the

description which we have given of this region, over by far the greater portion of its surface. In South Africa, Australia, and South America notably so. Also, as far as our knowledge of this country in North Africa extends, the same conditions seem to hold good. In Asia too, as a general rule, the same description applies to the greater part of the territory included in the limits of the Bush Country in that continent. It would, however, be too long to go over all this region in detail. In North, or rather Central America, however, the description of these latitudes as a bush country, fails, for reasons which we shall presently state, although considerable areas of regular bush do exist there also, notably in Northern Mexico.

The leading characteristics of the climate of the Great Bush Country generally may be briefly described as follows: that although the annual mean temperature is always decidedly lower than in the equatorial zone, yet the day temperatures run up considerably higher, especially during the dry season; and curiously enough, we think we do not exaggerate when we say that the *further* we get away from the equator, in these regions, the greater do these day temperatures become; while the nights become proportionately colder. In the section on climate, however, the causes of these remarkable phenomena have been gone into in considerable detail—it is because of the dryness of the atmosphere. The drier it gets, the more scorching do the solar rays become by day, and at the same time the more rapid does the radiation of heat become from the moment of sunset. But of course the extreme dryness of the atmosphere does

not reach its maximum until we get into the Desert Zone—our next division. It is there therefore that the most extreme sun temperatures in the world are recorded, often coupled with intense cold by night.

These circumstances have given rise to some differences of opinion as to the relative degrees of healthiness of the climates in the Bush Country, and those of the Equatorial Zone; some authors maintaining, that on account of the much more equable climate of the latter (where these tremendous heats are unknown) it is, taken as a whole, a better climate, and less trying to European constitutions, than tropical climates further removed from the equator, where the range of the thermometer is much greater.

There can be no doubt that there are many extremely unhealthy places in what we have designated as the Bush Country—where malarial fevers of severe type are endemic; but taken as a whole, we do not hesitate to give our verdict in its favour.

There, at any rate, there are some cool hours during the night and early morning, when sound refreshing sleep can be had by those to whom Nature has given constitutions at all suitable for residence in tropical countries; whereas under normal conditions in equatorial countries, the difference between the hottest hour of the day and the coolest hour of the night, is very slight. Then again, there is in the latter, so to speak, *no cool season*—whereas in the regions of single rainy seasons there are always more or less distinctly marked cool seasons, when the country is comparatively healthy. Also—apart from the direct influence of great solar heat upon the system, and the risk to Europeans from heat apoplexy, sun-stroke,

and so forth—it is a remarkable fact that the hottest season in these countries is by no means the most unhealthy: the sickly season is the rainy season, and more particularly the period immediately succeeding the cessation of the rains, when a powerful sun is drying up the saturated soil; at which time malarial affections are generally at their height. There is also, we venture to think, considerable risk of dysentery, and of fevers of a typhoid character, at the commencement of the rains; because the water in the streams, etc., is then at its lowest, and the first showers are apt to carry down into the water courses the accumulated impurities of months, which during the dry season are too often allowed to collect in their vicinity: consequently we generally find the advent of the rains everywhere marked by a large increase in the amount of sickness, both among the native population, as well as among the Europeans; and it is now a matter of ascertained fact, that dysentery, and especially typhoid fever,* are *mainly* (some go so far as to say, almost altogether) due, to a contamination of the water-supply. The mortality due to the use of an infected water-supply is probably the largest produced by any other single existing cause. The coming of the rains is also marked by the immediate re-appearance of malarial diseases; and jungles, and many other places, which the traveller could, with proper precautions, have traversed, and even resided in, for months with impunity during the dry season,

* Typhoid fever may be regarded, more than any other disease, as the bane of our Indian Empire. Where cholera for example kills its tens, typhoid kills its hundreds among the European garrison. It attacks the hill sanitaria as well as the plains stations, and no part of India is exempt from its ravages.

now become exceedingly unhealthy. The plague of flies also begins—this of itself is an unhealthy sign* — so that everything combines to impress upon the prudent traveller the necessity of an immediate retreat to some open, healthy situation, until the sickly season has gone by.

The moment the heavy rains begin to fall, though they usually have the effect of producing a refreshing coolness in the sultry air, fermentation of vegetable refuse is at once set up: dry leaves and other vegetable matter, till then harmless, begin to soften, and rapidly decay. This process is generally accompanied throughout the thick coverts by a sickly corpse-like odour, which then pervades their atmosphere: marking the (to us) detrimental change which is in progress.

Evil odours may almost always be regarded as Nature's danger signal. Certain scents are disagreeable to us, probably because they are hurtful and unwholesome. The nose therefore, as we have before observed, may be regarded as "The Sentinel of Health," on account of the sense of smell thus warning us of perils, even as a sentinel is posted to give intelligence of danger near the camp of an army.

In former days when these things were less well understood than they are now, many lives were lost by persons exposing themselves in jungle tracts at this unhealthy season, when some form of malarial disease of malignant type was but too apt to cut short their travels and their existence at one and the same time.

The phenomena which mark the advent of the rains, can hardly fail to prove exceedingly impressive to

* We shall have more to say, presently, respecting *flies*, as a medium of conveying infection and spreading disease.

everybody who witnesses them for the first time, but they have been so fully described in our chapter on Climates and Temperatures, that it will be unnecessary to enlarge upon them further in this respect. A good idea, however, may be formed of the extreme violence of the downpour which occasionally and indeed not infrequently occurs, if we mention that in 1891, in Bhownugger, in the Bombay Presidency, there occurred an extraordinary rainfall of *fifteen inches in twenty-four hours.** It is perhaps difficult to realize all that that tremendous deluge imports: but it is more than falls in six months, during an average year, in the leading agricultural districts of England, where the annual rainfall is under thirty inches for the whole year. †

In the zones of territory comprised within the Bush Region, as a rule, the coming of the tropical rains occurs with great regularity, so that their arrival can generally be calculated within a few days; and inasmuch as the whole of the pastures and crops of these lands depend upon these rains, it is impossible to overstate their importance; especially in a thickly populated country like British India, where it is stated, on the highest authority, that seventy-two per cent of the whole male population depend for their livelihood upon agriculture. § The failure of the monsoonal rains is thus synonymous with famine, all over Hindostan.

The water-bearing winds which convey these rains that give life and fertility to our Indian Empire, are undoubtedly the grandest examples of such phenomena

* London *Times* of August 3, 1891.

† *Encycl. Brit.* 9th edit., Vol. xvi, p. 114—Article "Meteorology."

§ See *The Imperial Gazetteer of India*, by Sir William W. Hunter (Director-General of Statistics to the Government of India), 2nd edit., 1885, Vol. vi, p. 482.

to be seen in any part of the world. According to the late Captain Maury, U.S.N., they blow over the whole expanse of space that lies between Africa and the Philippine Islands. It would, however, be too long to attempt anything like a detailed description of them here. The average rate of travel, during the "backing down" to the southwards of the S.W. Monsoon, may be set down as from fifteen to twenty miles a day, and the march of these great air waves thus proceeds under normal conditions, with almost as great regularity as that of a railway train moving from point to point, according to time table. Monsoons may be regarded as simply *deflected trade winds*. Throughout the vast expanse mentioned above, as Captain Maury explains,—

"The N.E. trades are called N.E. Monsoons, because instead of blowing from that quarter for twelve months, as in other seas, they blow only for six. During the remaining six months they are turned back, as it were; for instead of blowing towards the equator, they blow away from it, and instead of N.E. trades, we have S.W. Monsoons." *

The season of the tropical rains is everywhere more or less synchronous with the passing of the sun in the zenith: for the great luminary of the day is the hereditary keeper of the floodgates of heaven; as the sun proceeds north or south from the equator he opens them: the life-giving water descends, and the earth gives forth her increase. As the sun returns, and recrosses the zenith, on his journey back to the equator, he closes them again: presently the rains cease; the

* *The Physical Geography of the Sea*, by M. F. Maury, late U.S.N., 16th edit., 1877, pp. 365—66.

fields dry up; the crops ripen; and the harvest is gathered in.

Where there is a well-marked cool season, though there may be no actual winter, it usually follows the cessation of the rains. The rainy season has probably been hot and steamy, because of the more or less vertical sun, and the vapours exhaled by the heated earth; then, as the sun passes into another hemisphere, the evaporation of the superabundant moisture tempers the sultry heats: for, as we know, the conversion of water into vapour, by heat, is always accompanied by the abstraction of caloric. * This evaporation, proceeding upon a gigantic scale, therefore produces a more or less well marked cool season; and as the process becomes complete the hot season again sets in.

The seasons throughout the Great Bush Region are therefore three in number—the rainy, the cool, and the hot season. The second of these gradually disappears as we approach the Equatorial Zone, where people generally reckon *two* seasons only—the wet, and the dry seasons—which in their turn coalesce into a single season within the region of perpetual rains at the equator, where the climate remains almost unchangeable throughout the year. The Hindoos, we may here remark, divide their year into *six* seasons or "Ritus": (1) *Vasanda*, or Spring; (2) *Grishma*, or the Hot Season; (3) *Varsha*, or the Rains; (4) *Sharada*, or the Autumn; (5) *Hemanta*, or the Winter; and (6) *Shishera*, or the Cool Season. †

* This is the secret of the refreshing coolness of the ocean breezes, because the wind in its transit over the surface of the deep is continually evaporating and carrying off water in the form of vapour—so when they reach the coast these winds come in cool and invigorating.

† Murray's *Handbook for India and Ceylon*, 1892, p. xliii of the Introduction.

The advent of the rains brings with it an immediate and wondrous change. Where only just before all appeared dry, dusty, and lifeless, the whole face of Nature now bursts into verdure. The tremendous downpour which usually takes place, quickly converts the sun-dried earth into a mass of fertile mud; and as if by magic, trees burst into leaf; grass springs up; and the whole country rapidly assumes the aspect of a fertile garden.

After the long sleep of Nature in dry regions, this transformation often almost appears like the awakening of the dead to a new life. The Moslem prophet has in consequence adopted this metamorphosis as the Mohammedan symbol of the resurrection, and in several passages of the Korân it is used in this sense. In the old world, as we know, most of the dry, sun-stricken countries of the Northern hemisphere have been for centuries the stronghold of Islam: the "Dar-El-Islam" or the House of Islam, as they are termed by Mohammedans, in contradistinction to the "Dar-El-Harb," or the "Abode of the Enemy" (that is to say the country of the infidel). *

In many parts of India, and other tropical countries, no less than three harvests are gathered in, in the course of a single year, and sometimes even a fourth—

* The world, in the eyes of strict Mohammedans, is divided into these two great territories, and its inhabitants into but two great nations—the Faithful and the Infidel. The Moslem is a citizen of the whole of the Dar-El-Islam, and "El Kafir," or the Infidel, is the possessor of the rest. The climatic range of a certain form of religious opinions, as if they were a species of sunloving vegetable growth, is a remarkable fact—the Dar-El-Islam in the sense just quoted being pretty nearly coterminus with "the bush region" and our next division "the Desert Zone." Elsewhere it can, we think, be shown that Mohammedanism is more or less of an exotic—it flourishes neither in the Equatorial nor yet in the Temperate regions.

such is the wonderful productive power of the sun in combination with water. Upon the plains of Oudh, for instance, according to Sir William Hunter, the usual return of land amounts to three harvests annually, the "Rabi" in the Spring; the "Kharif" (the rainy season, or autumnal harvest) and the "Hewant" in Winter. From the Rabi, sown in October and November and reaped in March and April, the chief crops are wheat, barley, gram, peas, gujai, and birra; from the Kharif sown in June and reaped in October and November, rice, millets, sáwán, mandwa, kakun, and maize; from "Hewant" reaped in December, joár, bájra, mash, and other grains, in addition to the valuable tobacco, opium, and vegetable crops, and spices, such as cummin, aniseed, coriander, etc.—When the "Zaid" or fourth harvest is obtained, it is reaped in May. While the pay of ordinary agricultural labourers is about 1½d. per day, in money, when not paid in grain: and artizans, such as smiths, carpenters, etc., receive 4½d. per day in their own villages, or 6d. if called away from home.* It is therefore not to be wondered at if the price of wheat and other grains is lowered, and that the British agriculturist with his uncertain and variable climate finds it hard to compete with these and other duty-free over-sea borne bread-stuffs.

When the sun has had time to dry the soil, after the termination of the rains, in most countries adjacent to the tropics, this is as we have explained followed by a brief cool season. In Northern India for example this may be said to last from the end of November till the middle of February, after which the heat

* *The Imperial Gazetteer of India*, by Sir William W. Hunter, 2nd edit., 1886, Vol. viii, p. 498. *Ibid.* Vol. x, p. 375.

rapidly increases until May, which in most parts of India represents the height of the hot season. The period from March till the end of May may be taken therefore as the most trying and disagreeable of the year to Europeans, though it is by no means an unhealthy time, in any other respect than that of high solar temperatures. In Ceylon, however, April is the worst period.

Day after day during this hot season in the subtropical zones, the sun, arising in fiery glory, shines continually with a dazzling lustre, actually painful to the unshaded eye; and the incandescent rays, glowing in a sky of spotless azure, are poured down in a flood of glaring sunshine, of whose power and intensity those only who have themselves resided for some time beneath a tropical sun can form an idea. Photographs, for instance, taken during any part of the tropical day, are always conspicuous by the intensity of their shadows, which appear almost black, when contrasted with the glare in the sun-lit portions; and so completely parched does the ground become that in general its unprotected surface becomes so hot that it burns the hand when placed upon it, and it appears calcined and cracked in every direction. Rocks also become so heated that long after nightfall we have found sitting down upon them in thin trousers quite like taking a seat upon a hot plate. After the close of a hot day therefore the incautious sitter may have to jump up faster than he sat down; and when sitting down on any part of the ground by day a rug or some protection against the heated earth is often a positive necessity. The ground itself during the continuance of a long drought also becomes converted into a substance like sun-dried

brick, and it is then exceedingly dangerous to ride at speed over it, a horse's foot making no more impression and having no more hold upon it, than upon stone flagging.

In dry regions this sort of weather may last without a break for months, during which not a single drop of rain falls; each day as it comes round sees the sun arise in undiminished splendour, and as constantly pass across the meridian off a sky where clouds are rarely visible. Welcome therefore, both to man and beast, is the approach of evening during the hot season; when it comes to bring relief from the suffocating heat and glare of the day! and blessed is the refreshing coolness and tranquillity of the night, with its soft, balmy airs, its brilliantly starlit sky, and its marvellous effects of "chiaro-oscuro" created by the bright silvery whiteness of the moonbeams, when shown in contrast with the intense blackness of the shadows. In these regions the advent of night is thus always marked by a sense of restful enjoyment, the true *dolce far niente*, unknown to dwellers in more temperate climates.

Over large areas in South Africa in the hot season the nights are endowed with an additional charm, inasmuch as they are absolutely dewless, and a man may sit or lie out for hours after darkness has fallen, without his clothes getting in the slightest degree moistened by dews. This is very different in damp tropical climates, where the heavy dews will wet garments completely through in a very short space of time. In malarious districts especially, therefore, exposure at this time ought to be most carefully avoided, and when it is necessary to go out at night, it is better to wait for some hours, until the evening dew-fall has terminated. Dewless regions are rarely malarious.

Before we close our remarks upon the sequence of the seasons, a few observations upon the power of the sun's rays in tropical countries seem to us desirable. There can be no doubt that they are here possessed of a scorching and a penetrating power which they do not possess in the temperate zone. In England, for instance, we every now and again have intensely hot days, when the thermometer marks a temperature fully as high as that usually indicated on the hottest tropical day, say nearly 100° Fahr. in the shade; * yet as Mr. Wallace has been careful to point out:

"In England the noon-day sun rarely inconveniences us, or produces any burning of the skin; while in the tropics, at almost any hour of the day, exposure to it for a few moments will scorch a European, so that the skin turns red, becomes painful, and often blisters, and peels off. Almost every visitor to the tropics suffers from incautious exposure of the neck, the leg, or some other part of the body, to the sun's rays, which there possess a power as new, as it is at first sight inexplicable; for it is not accompanied by any extraordinary increase in the temperature." †

As a matter of fact, phenomenal temperatures are, as we have shown, by no means characteristic of the tropical zone, and they rarely or never occur there. The characteristic of a tropical climate is the more or less constant maintenance of high mean temperatures throughout the year: but the abnormal rise of the thermometer, for short periods, to an extraordinary height, is almost always recorded at places situated considerable distances *outside* of the tropical area—as for

* We have seen a temperature of 96° Fahr. registered in London. That day (as is common in such cases) was dull and misty.

† *Tropical Nature*, by Alfred R. Wallace, 1878, p. 7.

instance in the desert zone, or in the warmer, or even the colder temperate regions.

It is also remarkable that upon these rare occasions the sun is often apparently not shining with its full lustre, but the day is dull, and even sometimes overcast with haze or mist. At such times, contrary to expectations, the heat has seldom the same penetrating or dangerous power, possessed by the sun on an ordinary tropical day; true, in places like New York or London the passage of a great heat wave is frequently followed by alarming results, but we are nevertheless disposed to think that most of the fatalities are due on such occasions to the sufferer's own imprudence; and that an investigation would show that the individual (unless previously in a bad state of health) has undergone exposure on an empty stomach, or has recently indulged in excessive use of intoxicating liquors. These should never be partaken of during great heats while the sun is above the horizon.

In the tropics, however, the power of the sun's rays must be regarded as a perpetual and ever-present source of danger, against which the European requires to be constantly on his guard, and against which there is no such thing as acclimatization. We shall therefore merely remark that a very common cause of accidents in the tropical zone is the practice of using clothing and tents of insufficient thickness, because of their superior lightness; many a man has been severely burnt while sitting beneath the shelter of a single-canvas awning or tent; we take occasion to refer to it here, with a view to impress upon the reader the folly and the danger of living in these countries insufficiently provided in this way, under the mistaken notion of obtaining a

slight reduction in the weight to be carried. We may rest assured that the sun will strike through any such flimsy materials, and that they will afford practically no adequate protection against the rays of a tropical sun. It is a common thing to hear people say, "light clothes are best for hot weather." If we take this to mean thin things—we say no: very thin clothing is undesirable, for the same reason that single-roofed canvas tents or straw hats are undesirable, namely that the sun strikes through them. By all means let the weight be light, and the colour light—but you must have a certain amount of substance to withstand the sun; this may be effected by using sun-pads, or wearing several very thin garments one over the other, according to ancient Oriental custom, and in various other ways, which would be too long to enter into here.

Thus, Solymos in his "Desert Life" mentions, that on one occasion at Dongola on board a Nile boat, he was sternly reminded of this fact, after incautiously exposing himself under "a stout awning" in thin things. For he tells us that—"During an hour's lounging under this shelter, dressed only in a thin calico robe, more than half my body was burnt red, and smarting." * Probably quite half the cases of sun-stroke that we hear of are brought on by people exposing the back of the neck and spine to the direct influence of the solar rays, insufficiently protected. Protection to the eyes from sun-glare is also of extreme importance. It is now a matter of well ascertained fact that sun-stroke may occur by exposure of the eyes, quite as much as by that of any other part of the frame. These incautious exposures, moreover, seem to be

* *Desert Life*, by B. Solymos, 1880, p. 25.

specially dangerous when persons are kept waiting and dawdling about, while not in active exercise. This is no doubt due to the fact that perspiration acts as a powerful protection against the sun, but when people are kept standing about this action of the skin is not stimulated. In the old days in India, before these things were properly understood, therefore, it was of frequent occurrence for troops injudiciously exposed to the sun in this way, to suffer severely; and parades, for guards of honour, funerals, and other pageants, have been known to be followed by the most lamentable and fatal consequences. Captain Lugard, an experienced officer, in his recent work on East Africa, has given some sound and sensible advice about these matters:—

"More harm" (he says) "is done by standing in the sun, or running out of the tent for a few minutes into the sun, with no hat or only a small cap, than by any number of hours of walking in the hottest part of the day." *

He is a great advocate against all unnecessary exposure to the sun when not in active exercise, and believes that when walking thirst should be freely quenched with water, or very weak tea, which assists in keeping the skin, and especially the head, in the moist condition which renders it almost proof against the sun. † The comparative freedom of troops or travellers from serious illness, when constantly on the march, seems strongly to bear out the soundness of these views: whereas the very frequent occurrence of fever and other forms of illness, seems the almost invariable result of remaining stationary in camps and cantonments. Moreover, there is another, and if possible

* *The Rise of Our East African Empire*, by Captain F. D. Lugard, 1893, Vol. i, p. 34.

† *Ibid.*, p. 34.

even still more fatal form of attack due to exposure to high temperatures, known as heat apoplexy, to which persons living in this way under shelter are subject. Sun-stroke (*Insolatio*) from the direct exposure to the sun's rays being only one form of these seizures.

Heat apoplexy, a syncopal form of heat exhaustion, on the other hand is apt to proceed from a high temperature, coupled with insufficient ventilation, and not from direct influence to the sun. Therefore it may, and often does, come on at night, when there is no sun—as for instance on board vessels running through the Red Sea during the prevalence of a hot wind. The direction of these winds is generally from the N.N.W. in the northern and from the S.S.E. in the southern portion of that sea. Firemen and the engine-room staff on board steamers throughout the British merchant navy are consequently, as might be expected, the greatest sufferers. We have taken the trouble to closely examine the monthly returns of the Board of Trade of the deaths of British seamen for a period of consecutive years, and we find that the preponderance of deaths from heat apoplexy among them is very marked. We are aware that it is usual as far as possible in hot voyages to employ Malays or Negroes, but we find that they suffer about as severely as Europeans; and many "Lascars" die of it, as these returns show. We also find a large preponderance of deaths from malarial fevers among the engine-room staff. We lay stress upon these facts because they show that the direct exposure to the sun is by no means the thing most to be dreaded, provided of course that proper precautions are used; if it were so we should naturally expect to find the navigating officers

mostly affected, as they are more in the sun than the others—but it is not so—it is the engineers, firemen, stewards, and cooks, whose duties keep them out of the sun, who suffer most.

Exposure to the direct influence of the sun's rays, when proper precautions are taken, seems therefore to become dangerous only when it is very long continued—and above all, when from fatigue, or other causes, the system is suffering from exhaustion; it is to the latter fact especially that the deaths of soldiers on the march by sun-stroke are to be attributed—and we may add to the use of ardent spirits, as the use of stimulants, before or during exposure, has been found to have a direct tendency to increase both the number and the fatal character of these attacks.

Active exercise in the sun, even during the hottest weather, of itself however, as we have said, rarely proves injurious, where these and other preventable and unfavourable conditions are eliminated. Thus tiger shooting in India is most successful during the height of the hot season, when a leather guard is sometimes necessary to shield the hand from the heat which the sun has imparted to the gun barrels; yet the unanimous testimony of all sportsmen out after tigers goes to show that they rarely or never get sun-stroke. So also during the Indian Mutiny in 1857 the European troops had to make long marches throughout the hottest season of the year. The great outbreak had in fact been timed to coincide with the hot season, in the hope that the great heat would unfavourably affect Europeans in their operations in the field: * but this expectation proved

* This outbreak of the Great Mutiny began at Méerut near Delhi on May 10, 1857, *i.e.* at the height of the hot season. It was, however, in no

delusive: the men *did* march, and fought, and conquered, against enormous numerical odds, in spite of it; and throughout the numerous wars waged by Great Britain under similar trying conditions, our medical officers and our generals have often commented upon this remarkable fact, that so long as the men were daily on the march, and that the stimulant of the excitement of active service in face of the enemy was continued, the army seemed to be wonderfully preserved from disease. During the Indian Mutiny, their hardihood and feats of marching, performed in the hottest weather, repeatedly excited the wonder and unwilling admiration of the Sepoys, who had no idea that European troops would have been able to undergo such a strain in that season. This circumstance therefore baffled all their calculations: and yet the moment that the necessity for active exertion came to an end, reaction set in and the health of the Europeans began to suffer. Severe outbreaks of disease are, in fact, very apt to occur, whenever men remain stationary for any length of time, during the hot weather; if they are kept in fixed camps or cantonments, sickness is, as we have said, almost sure to follow—partly, because men's "morale" suffers from inaction, and because the tedium of existence often produces profound depression of spirits, as each day comes round and seems longer, and hotter, and duller, than the previous one; partly also from physical causes: the liver, for instance, becomes inactive, through want of exercise, the rest becomes broken at night, and the man becomes generally out of sorts, active and interesting work being the great agency of Nature

sense an uprising of *the people* of India, but a military revolt confined practically exclusively to the native army of Bengal.

for carrying off morbid matter, by promoting the free action of the skin. Thus men of sporting tastes are generally the best and healthiest men in tropical stations; their love of field sports causes them to be much in the open air, and therefore necessarily causes them to incur much exposure to the sun; yet the whole experience of Indian life shows that these men almost always keep in good condition, when men of inactive, stay-at-home habits, sicken and suffer both in health and in spirits. It seems as if man, following the primeval habits of his race as a hunting animal, thus most perfectly acquires that physical training and endurance which fits him to prevail in that great struggle for existence which is always everywhere going on.

The surface of the Bush Country may be roughly divided into three great classes of land: 1st the Heavy Forest, 2nd the Jungle, and 3rd the regular "Bush," or open park-like country from which this region takes its name. As regards the first of these, the heavy forest lands, they are principally confined to alluvial tracts where the soil is damp and fertile, or else to well watered ravines and valleys among hills. In such situations stretches of forest more or less equatorial in their character, are frequently found, especially in its lower latitudes adjacent to the equatorial zone; and everywhere throughout the Bush Region, magnificent timber of most valuable character, is found growing in favourable situations, throughout the best portion of the heavy forest.

As we remove further away from the equator, evergreen trees gradually become fewer in number, and those of a deciduous habit assume a prominent feature, especially on mountains and other elevated places.

Among these deciduous trees, the Indian Teak (*Tectona Grandis*) stands pre-eminent, both from its value in a commercial point of view, and also for its splendid proportions and beautiful foliage. In Central India these trees attain a girth of from ten to fifteen feet, with a stem of seventy or eighty feet to the lowest branches. * In the forest covered hills, even so far south as Central India, Captain Forsyth reports that not only the teak, but almost all the trees of these forests are deciduous: the Sâl tree (*Shorea Robusta*) being about the only considerable exception to this rule—this latter being, according to the high authority of Captain Forsyth, "almost the only evergreen forest tree in India." † We make particular note of this in order to call attention to the fact that the onset of the dry season, and the intense power of the tropical sun in these climates, exercise the same effect in producing the fall of the leaf as the frosts of winter at home. The great similarity between the effects of intense dry heat and intense frost, are in this, as in many other respects, exceedingly remarkable. These points of resemblance will be more fully considered in our Arctic section; but as regards the effects of great solar heat, we shall merely mention here that one of our leading authorities states that "on the east coast of India, the vegetation is interrupted for a longer period by the dry season, than in Europe by the winter." § On the other hand some few equatorial evergreen plants, when transported into

* *The Highlands of Central India*, by Captain James Forsyth, Bengal Staff Corps, and Indian Forest Department Service, reprint of 1889, p. 213. † *Ibid.*, p. 371.

§ *The Cyclopedia of India*, by Surgeon-General Edward Balfour, 3rd edit., 1885, Vol. i, p. 1246.

a cooler region, will occasionally assume a deciduous character—but generally after a season or two the plant perishes: it catches cold, and dies exactly like a bird or animal exposed to the inclement influence of a foreign climate.

Returning, however, to the consideration of the teak and other trees of special value which are habitants of the Bush Region, we may remark that in the rainy season, when the teak comes into leaf, it is surmounted by a magnificent crown of large shining leaves, each some 15 to 18 inches long, and masses of yellowish white flowers, which render it one of the most majestic and picturesque objects in the landscape; while at the same time it is one of the most valuable of all trees, producing, according to Captain Forsyth—

"perhaps the most generally useful timber in the world.—In combined lightness, elasticity, and endurance (he says) there is none to compare to it: its uses cover a wider range than those of any other timber, from the handle of an axe, to the backing of an iron-clad." *

But if the teak reigns supreme as the "Queen of the Forest" in our Indian Empire, it is closely rivalled both in beauty and utility by the mahogany tree (*Swietonia Mahogani*) in the western hemisphere; which, though found growing in the equatorial forests from about Lat. 10° N., only attains its finest proportions further to the northward, where it is undoubtedly the most valuable and magnificent of all timber trees in the tropical forests of the western world.

At one time immense forests of this noble tree ex-

* *The Highlands of Central India*, by Captain J. Forsyth, New Edit. of 1889, p. 31.

tended throughout the highlands of the interior of Central America, St. Domingo and other places; where it grows to a gigantic size, its head towering far above all other growths, and bearing aloft a splendid crown of light green leaves, something resembling those of the European ash. "Its trunk is often 50 feet in height, and 12 feet in diameter, and ramifies higher up into so many arms, that the shadow of its crown covers a vast surface."* At one time St. Domingo mahogany was most esteemed, but some of the finest timber of this kind which the world now produces comes from the British settlements in Honduras, which were established for cutting and shipping these trees, as long ago as 1638 and 1640, from which period the right to this territory has been constantly maintained by Great Britain, against the pretensions of Spain, chiefly on account of the importance of this industry.

The task of conveying these immense logs for great distances through an almost impenetrable and trackless forest, is as might be expected a very arduous one. The work commences during the rainy season, in August, when gangs of twenty or thirty men, under a captain, are employed to search for and cut the timber, for whose conveyance roads have then to be made, upon which the logs, after being squared, are conveyed on trucks during the dry season, when the ground is firm, to the banks of a neighbouring river, upon whose waters they are floated, during the next rainy season, down to the sea.†

The dense and equatorial nature of the forests of

* Stanford's *Compendium of Geography and Travel for Central and South America*, edited by H. W. Bates, 1878, pp. 94—96.

† *Ibid.*, pp. 94—96.

Central America cannot fail to strike every observer, and they maintain this character far beyond the limits which we have assigned to our Equatorial Forest Zone. It may therefore appear to be somewhat difficult to reconcile this fact with the theory of the existence of climatic zones encircling the earth.

We, however, venture to think that it is by no means inconsistent with it, for as we have already pointed out, there are no hard and fast lines in Nature: like the margins of the ocean, these different territories are at all times liable to be pushed backwards and forwards, at particular points, owing to local circumstances. In the sea, this is governed by the elevation and depression of its shores—upon the shores of the climatic zones, it is governed by the winds of heaven. According to the natural law, the set of prevailing winds is produced by variations of temperature, which thus cause these winds to blow with more or less regularity in a certain direction. We have endeavoured to explain these matters, to the best of our ability, in our section on "Climates and Temperatures," to which we beg to refer the reader for a fuller statement of these subjects. Now, in the special case before us, we find, as we have said, that a dense forest of thoroughly equatorial character, runs up far beyond the usual limits of that great forest zone, and that it covers a very large proportion of what would naturally form the Bush Country in Central America. How shall we account for this phenomenon?

In the first place, what creates the dense forest growths of the equatorial zone is the permanency of high temperatures and *moist* atmosphere, combined with a superabundant water-supply derived from the

constant rains at the equator. If these rains were to cease to fall, and the land was to become parched by the intense solar heat, which would certainly follow that catastrophe, there can, we think, be little doubt that the great equatorial forests would wither away and perish. So also, if these abundant rains were by some combination of causes, carried up into the region of the great bush country, they would carry the equatorial forest growths with them.

This is exactly what occurs in Central America. A glance at the map will show how narrow the continent is at that point; and the vast expanses of ocean, which stretch forth from its shores on either side.

Now, the prevailing set of the trade winds are from the North East; these winds blow, with marvellous regularity, for many months throughout the year, and arrive upon the Central American coasts surcharged with watery vapour, gathered in their passage across the ocean. The next fact to be observed is, that all through Central America a lofty range of mountains forms the back-bone of the continent there. It is known among the Spanish speaking people as the *Sierra Madre*. These mountains necessarily cause an upcast draught to take place, and thus the water-laden winds are driven upwards into a colder atmosphere, which at once condenses a great part of their vapour —hence the damp, moist heat and abundant rainfall of these regions. The formation of clouds prevents the rapid radiation of heat by night, and thus a high temperature is constantly kept up. The luxuriant equatorial forest growths therefore, following the lead of Nature, have overspread the whole of this country. A great deal of the vegetation is evergreen, but the

admixture of deciduous trees nevertheless shows that this region is outside the limits of constant rains. These great forests are full of the most valuable timber, and contain many of the choicest productions of the tropics—a good number of which are doubtless still unknown, for the labour of exploring such places is immense, even when they are sufficiently open and free from malaria to warrant men of science in undertaking this difficult task.

Leaving therefore the heavy forests of the Bush Country we pass on to survey its characteristic features as "The Great Jungle Country."

The word "Jungle" (as the Hindi form of it "*Jungli*" imports) consists of land that is "wild, uncultivated, and useless,"* covered generally with a growth of dwarf trees, bamboos, and other arborescent grasses, but dotted over here and there with some trees of nobler growth. There are large areas of this sort of country consisting of intensely thick scrub, not exceeding from fifteen to twenty feet in height, intermixed with thorny creepers and other prickly plants, which render many parts of it quite impassable without the free use of the axe and slashing hook, except in places where heavy wild animals or the jungle people have beaten narrow paths through the thicket. There are, however, other tracts which consist entirely of giant grasses. Dr. Schweinfurth, for instance, describes vast districts on the elevated table lands of Central Africa, which are covered with this "grass forest," as he calls it. † In India also, there are considerable tracts of just such grass jungle. Staff

* *The Cyclopedia of India*, by Surgeon-General Edward Balfour, 3rd edit. 1885, Vol. ii, p. 454.

† *The Heart of Africa*, by Dr. Georg Schweinfurth.

Colonel Forrest, among others, writing in the early part of this century, gives a good description of such a tangle, seen while out shooting, which is worth repeating:

"The height of the grass struck me as particularly wonderful. I was mounted on a very fine elephant, not less than eleven feet high. The howdah must have been full two feet higher. Now when standing upright, the attitude usually adopted by sportsmen in order to see better around them, my head must have been very near nineteen feet above the ground. But the grass was generally three, and in some places six feet higher than my head. The stalks were fully one and a half inches in diameter, and it would be almost impossible to force a passage on foot, independent of the chance of meeting a tiger suddenly." * [This grass jungle was near Fatehpur, close to the Bahar boundary.]

In many tropical lands, a wide belt of unhealthy jungle country extends along the coast line, and forms a serious impediment to opening up the country to commerce, or to the movements of travellers, and others desirous of passing rapidly through it, in order to reach the less densely wooded and more salubrious highlands of the interior. This state of things is notably found to exist along the sea-board of both sides of the African continent, as well as in many other parts of the world.

The pernicious fevers which guard the pass into Western Africa, for instance, have from time immemorial rendered the settlement of Europeans, except at a few points, impossible; and have preserved those regions almost as a *terra incognita* to the present day.

* *Picturesque Tour along the Rivers Ganges and Jumna*, by Lieut.-Colonel Chas. R. Forrest, H.M. Staff Corps, Illustr., 4to, 1824, p. 134. (There are beautiful illustrations of Indian scenery in this book).

Much of the land along this coast is pestilential swamp.

Other exceedingly malarious jungles are found stretching forth along the base of mountain chains, running through tropical countries; of which the Indian "Terai" forms a good example. Although malaria always exists in hot climates, wherever there are fertile tracts, and a humid soil, it finds its stronghold in the jungle rather than in the forest. This may be partly due to the fact that in the heavy forests the ground is protected in a great measure from the heat of the sun, and also that in many places the innumerable armies of ants, and other forms of insect life, quickly consume the fallen leaves and timber, which thus are not suffered to remain on the ground to rot.

Moreover, the heavy forest rarely does well in the worst districts, where the land is soft and swampy; such localities being generally occupied by reeds, and other jungle growths. Therefore along the bases of mountain chains, the jungle usually flourishes in the most unhealthy spots, such as the bottoms of ravines and valleys, while the great trees are mostly found along the drier hill slopes, where it has frequently been remarked that the finest timber grows in the most inaccessible places—probably because their very inaccessibility has guarded the trees against the assaults of wood-cutters and other jungle people. The deadly character of the Indian Terai, which skirts the southern base of the Himalayas, has been already adverted to.* Along the foothills of the Andes similar sickly districts are found in many places, notably where the bush region of Peru runs up the gorges, from its

* A description of the Terai will be found in our chapter on "Great Mountain Ranges."

junction with the dry plains. These bare table lands, here called "El Tablazo" by the natives, are generally fairly salubrious. There can be little doubt as to the cause of the malarious nature of the jungles in such localities: they receive the whole of the water descending from the hills, which here often forms swamps and pools, or else lies hid beneath the surface of the detritus carried down during ages by the torrents in the rainy season. As malarial germs are always abundant at the bottoms of ravines, which act as a species of conduit pipe for conveying it to the hills—the water is sure to carry an abundant supply of these germs down with it. This is unquestionably the case in the Terai, where many of the streams are actually poisonous.

The exact way in which malaria is given off from the earth, or is carried from place to place, is as yet only imperfectly understood; but that the germs may be absorbed, or held in suspension, *by water*, seems certain. Considerable numbers of persons, for instance, have been known to be struck down at once, after drinking water from a stream in the Terai.* Sudden outbreaks of malarial fever among the passengers and crews of vessels some time at sea, are also supposed to be due to contaminated drinking water, brought on board while the ship was in port. Nothing therefore can be further from the truth than the Hindoo superstition, that water cannot be contaminated.

That being so, we think we are entitled to infer that at certain seasons the water of streams flowing

* See our section on "The Great Mountain Ranges" and an account of such an occurrence given there.

through ravines among hills, where malaria is known to be rife, may be, and is, carried down to the jungle belt extending along the base of the mountain range in a contaminated and most dangerous condition—and if so, it follows that the subsoil in these jungle districts, which is usually water-soaked (though the surface may appear to be for the most part dry), is almost always surcharged with these malarial germs, whose deadly exhalations render a night passed by Europeans in such localities, at certain seasons, almost sure to be followed by a severe attack of malarial disease. The death of Lady Canning, wife of the celebrated Lord Canning, first viceroy of India, from malarial fever, after *only one night* passed in the Terai on her way down to Calcutta from Darjeeling, furnishes a sad, but remarkable instance in point. We may add that the most dangerous times for crossing malarious tracts of this description, are the first day or two of the rains, after a long drought: because the sudden descent of what are most generally torrential rains, mechanically displaces and causes an overflow of the malarial germs, till then lying dormant in the subsoil; but above all, when the country is drying up, for some time after the cessation of the rains: malarious districts are at this period of the year hot-beds of fever and disease. The safest period for crossing such places is during the latter part of the dry season, because the surface of the ground, except in sandy tracts, is then generally hardened by the sun into a substance resembling sun-dried brick, which forms a crust, to a great extent impervious to the passage of malaria. Such at least is our belief, but the state of knowledge upon such matters is thus far, as we have already explained, very

imperfect, and the best authorities are often at variance with each other about them.

As regards the crossing of malarious districts, it is prudent, in all cases whenever such an arrangement may be possible, to cross them during the day, and on no account to encamp in them at night. If, however, a night must be passed there the men should be confined as much as possible to their tents. They should also be given considerable doses of quinine as a prophylactic, and hot strong coffee to be taken immediately after sundown. Very small fires made *in*, or at the door of the tents is another useful precaution, and large fires to windward of the encampment kept burning all night when practicable, afford further protection. The value of mosquito-curtains at these times is also a matter of ascertained fact.

We must now proceed to give some account of the giant, or arborescent grasses, as they are called, which form so prominent a feature of jungle vegetation.

The first and largest of this class of plants are of course the bamboos; we have, however, given short descriptions of the most remarkable of these in our section on the equatorial zone, and shall therefore confine ourselves at present to saying that though the jungle bamboos may be generally less gigantic than the great representatives of their class already alluded to, they form nevertheless a leading feature of the dense, or swampy, jungle region. They are of all sorts and sizes, from the common yellow bamboo (*Bambusa Vulgaris*) which often grows to a great length, down to small reed-like species, not thicker than the stem of a tobacco pipe (the *Bambusa Metake*, a Japanese variety which

is quite hardy, and *B. Simmonsi*, another small bamboo of a somewhat similar kind, form good examples of these small species, sometimes used for bedding purposes in English gardens). Some of the jungle bamboos are covered with terrible spines and thorns; planted closely together in rows such bamboos make beautiful hedges of most ornamental and impassable character. The *Bambusa Blumeana* for instance is a prickly bamboo, which makes cattle-proof hedges of great strength. It was originally found in the hill districts of Java, we believe. Then there is the valuable male bamboo (*Dendrocalamus Strictus*), a hardy and thorny species, which sometimes grows to a large size, and has the peculiarity of having a solid stem. Small specimens are therefore in use for lance shafts, hog spears, etc. Among the smaller and more ornamental kinds we may notice the beautiful *Arundaria Hookeriana*, with a blue-green, or purple shaded skin—a native we believe of the Himalayan jungles—which is rarely thicker than a walking stick, and one of the most ornamental sorts that we have seen. There are specimens of it to be seen in the Botanic gardens at Darjeeling.—Captain Forsyth, formerly conservator of forests in Central India, gives many interesting details about the Bambusaceæ: the feathery heads furnish a valuable fodder for stock throughout the year, and the young shoots make a useful vegetable, much relished by many natives of the East,* while the seeds supply the peasant population with a valuable grain. The seeding of the bamboos, when it becomes general, is therefore quite an event

* See respecting edible bamboo shoots, *The Industries of Japan*, by J. J. Rein, p. 227.

in India; for although a certain number of them seed every year,

"A general seeding of bamboos occurs only once in about thirty years; when every bamboo over a vast tract of country will drop its leaves, and form at the end a large panicle of flowers, followed by the formation and shedding of myriads of seeds, hardly to be distinguished from rice. This done the bamboo immediately dies, while a fresh and vigorous crop at once begins to spring up from the seed." *

According to Smith's Dictionary of Economic plants, a general flowering of bamboos took place in Bengal and other parts of India, from 1864 to 1866.† It is now, however, as we have before stated, an ascertained fact that bamboos of most kinds, besides propagating themselves by seed, will throw out "suckers" from the roots, much like a gigantic species of couch grass, when the old shoots die down; and some species do not die at all after seeding. In these cases much will depend upon soil and circumstances.

But although the bamboo is the largest and most remarkable of the arborescent grasses, there are many other kinds which grow to a height of from twenty to thirty feet, with stout woody stems, sometimes considerably thicker than a man's thumb; which form the almost impenetrable grass forests, or jungles, which cover considerable extents of country in many tropical regions. In these dense coverts, an army might be hidden from view, as completely as a rabbit in a European meadow. Many of these grasses grow in immense tussocks, which in India are usually included

* *The Highlands of Central India*, by Captain James Forsyth, Bengal Staff Corps, 1889, p. 100.

† *Dictionary of Economic Plants*, by John Smith, A.L.S., article "Bamboos."

under the general term of "elephant grass." * These grass jungles often figure in pictures of tiger-shooting, and other Indian sports, as under shelter of their dense and matted thickets, tigers and other heavy game make their lairs during the hot season. Mr. Sanderson, for instance, in his interesting work on Indian jungle sports, frequently mentions their almost impassable nature, and says they form immense coverts in the jungles of Mysore and other parts of Southern India; and he states that among other rank jungle grasses, he has seen the well-known Lemon grass of Ceylon, growing in places to a height of eighteen feet. † This valuable grass *(Andropogon Schœnanthus)* emits when crushed a strong scent of lemon; it grows in immense quantities in the highlands of Ceylon, as well as in Southern India; but its height in general does not exceed some seven or eight feet. Lemon grass when young forms a most valuable pasture for all kinds of cattle; but when old, like most of the other large growing grasses, it becomes exceedingly hard and wiry; its leaves will cut the hand like razors, if rudely grasped, and its stems more resemble branches of small trees or shrubs than grasses. Hence the term *Arborescent Grasses*. A strongly scented essential oil is distilled from its leaves, known in commerce as "Citronelle Oil"; in which a considerable trade is carried on. §

* The true elephant grass of India is *Typha Elephantina*, which grows along the banks of rivers, and whose roots penetrate to a great depth (often 9 feet) into the ground. (See *The Imperial Gazetteer of India*, by Sir W. W. Hunter, Vol. vii, p. 14).

† *Thirteen Years among the Wild Beasts of India*, by G. P. Sanderson, 2nd edit. 1879, p. 37.

§ *The Commercial Products of the Vegetable Kingdom*, by P. L. Simmonds, 1854, p. 572.

Another remarkable scented grass indigenous to British India, is the deliciously perfumed Khus-Khus grass of Rajpootana (*Andropogon Muricatus*), of which mats and other fabrics are made. It is a very coarse, woody fibred plant; things made of it are sometimes sold in London, in the form of fans and other small articles. Its peculiarity is that when it is wetted it emits a delicious aromatic fragrance, something after the same kind as sandal wood, which quite perfumes the air of houses. It is therefore much used in the form of mats, for hanging across doorways, verandahs, etc., in India, during the hot weather, where, as it is then constantly kept wetted with water, it fills the adjacent rooms with its fragrance. The practice is however not one that ought to be encouraged among Europeans, as the cold damp air, though pleasant at the time, is apt to cause chills, which lead to rheumatism and congestion of the visceral organs, etc.

In nearly all works of African travel we read of the density of the great grass jungles of the interior of that continent, which vary from three or four feet in height on the plains, up to gigantic arborescent grasses which render some countries very difficult of access, during, and after, the rainy seasons. Emin Pasha among others has made frequent mention of these great tracts of grass forest, which wherever there is an accumulation of water without heavy timber, seem to take the place of trees, and form impenetrable coverts, so dense that considerable strength has to be used to enable a man to force his way through, while masses of reeds of imposing height, springing up between the other grasses, often

add not a little to the difficulty of the journey. *

Dr. Schweinfurth in like manner describes the grass in the Nyam-Nyam country, as quite fifteen feet in height, with stalks as hard as wood, and as thick as a man's finger. † Sir Samuel Baker also relates his troubles with the Bari, and other wild tribes, during his government of the Soudan, and describes the difficulties and dangers of his retreat through long grass plains of this character, where his enemies lay hid in the tall grass, and fired out upon his caravan with poisoned arms, etc., as it made its way painfully along. §

These African long grass forests are generally found in districts of either a highly elevated or swampy character, wherever in fact the tree growths are absent. Some of the gigantic reeds of these countries are also of a wonderful character: one of the most notable of these being the celebrated Egyptian Papyrus (*Cyperus Papyrus*) which is still found growing in immense quantities in the swamps along the Nile, to the southward of Khartoum. It was from this reed, as is well known, that the celebrated *Papyri* of antiquity were obtained, which formed in past ages the paper upon which the ancient Egyptian writers inscribed their records; specimens of these papyri thus written upon, found in the tombs, have been handed down in an admirable state of preservation, and form perhaps the most valuable historic relics of ancient Egypt at present extant.

* *Letters from Central Africa*, by Emin Pasha, 1888, p. 19. (Translated from the German).

† *The Heart of Africa*, by Dr. Georg Schweinfurth, 1874, Vol. i, p. 337.

§ *Ismailia*, by Sir Samuel W. Baker, 1874, Vol. ii, Ch. ix, "*The March to Kionga.*"

In India we find the pith of another species of water reed largely made use of for the manufacture of sun helmets; this is the inner portion of the "Sola Reed" (*Œschynomene Aspera*, Linn.), a reed about the thickness of a heavy walking stick, which grows in pools and swampy places in tropical Bengal and Madras.* The exterior rind is of a dark brown colour, while the inner portions consist of a soft, almost snow-white pith, which is very tenacious, and can be divided up into thin strips, almost like paper, which is cleverly worked up by the native workmen into hats and helmets, entirely impervious to the strongest suns. They are made by adding layers of this pith to each other until a substance about half an inch in thickness is formed, which is light as a feather, and as a protection against the sun comes as near as possible to perfection; but these sola pith articles will not stand rain, and soon go to pieces in wet weather. The best "Shikkar hats," for shooting in the hot weather, are of this kind, made in two parts, in the form of a large mushroom: the upper portion being separated by the thickness of a finger from the lower, and only attached to it by wads of pith at intervals, so that when there is a wind, it quite blows the hair about, inside the hat.

These hats may be seen in process of manufacture, in some of the Calcutta bazaars, and also we believe at Madras; beautiful specimens were sold by a poor native workman, who attended the passing of the trains and sold them to passengers, at the station of Badulla, on the railway between Calcutta and Darjeeling, not far from Silliguri, where the line enters

* See Sir J. Hooker's *Indian Flora*, Vol. ii, p. 152.

the Terai, the great malarious jungle district of which we have already spoken. To give an idea of how cheaply excellent things can be made in India, we may just mention that this poor man used to charge 8 annas for one of these hats, but of late years has risen his price to the enormous total of 12 annas, or say about 10½d. in British money at the present rate of exchange, for which sum we lately got one from him. The *Sola Topee*,* we may here remark, of course means "a sola reed hat," but this has been corrupted by Europeans into *Solar Topee*, or "Sun hat" in mongrel English, and forms a good specimen of the absurd changes and corruptions often wrought in words and languages, which, becoming sanctioned by time and fashion, at last become recognized figures of speech, of which the original source is forgotten.

Another remarkable group of great grasses are the *Saccharineæ*, or sugar-producing plants, which flourish wherever damp soil and moist atmosphere are combined with a high temperature. Sugar is produced by a great variety of plants and grasses, and some palms, but of these, we need hardly say, the sugar cane (*Saccharum Officinarum*) is the leading and most valuable example. Its average height is about nine feet, but sugar canes are sometimes fifteen feet high, and nearly two inches in diameter. To the European palate the pith, when chewed, has a very sweet but rather sickly taste, though many natives in the sugar districts seem very fond of it.

Originally a plant of the old world, the sugar cane was cultivated in China before the historical era; and

* "*Topee*" is Hindi for "*hat*," and "*Sola*" is the Indian name of he reed.

was subsequently, according to Professor Meyen, introduced by the Spaniards into the West Indies, in 1520; when the first sugar cane was raised in San Domingo by Pedro de Atienza.* It seems also certain, according to the same authority, that the art of boiling and cleaning sugar had likewise been learned from India and China, where the process was practised from the earliest times.†

The profits made by the culture of the sugar cane, when the crop comes to perfection, are sometimes enormous, as the immense fortunes that have often been realized from it sufficiently prove. But the price of sugar has fallen greatly of late years.—The cane is easily propagated from "sets" or cuttings, made from the tops; the products we need hardly say, being threefold: molasses, sugar, and rum. The risks of the sugar planter are however considerable, as the cane has many insect enemies, and is very subject to injury by unfavourable weather; also the districts where it succeeds best are often the home of malarial disease of severe type.

Finally we may add, on the high authority of the German philosopher Alexander von Humboldt, that the yield of sugar from the cane grown in the East Indies is greatly superior to that grown in the West Indies; for in Bengal, according to Humboldt, the produce is twice as great as at Havanna.§ The sugar cane requires a period of dry weather, and intense hot sun, to perfect itself as a sugar-bearing grass; both which conditions are admirably fulfilled in Bengal. For these

* *Botanical Geography*, by F. J. F. Meyen (Professor of Botany at the University of Berlin), 1846, p. 380.

† *Ibid.*, p. 382.

§ *Ueber Neu-Mexico*, by Alexander von Humboldt, Vol. iii, p. 116.

reasons it does not do well in equatorial climates, as in consequence of the want of a dry season, the cane does not mature to perfection there, and the yield of sugar is in consequence low.

Another class of jungle plants which deserve a passing mention are the numerous varieties of rattans and other creepers, mostly thorny, which overspread portions of the scrub bush in the tropical jungles. Their conduct in this respect very much resembles that of the giant cable-like lianas of the Equatorial Zone, which there make their way to the tops of the highest trees. Rattans and other canes are however mostly ground creepers, and merely cover bush and trees of the smaller size.

"Nothing," says Mr. Sanderson, speaking of this class of plants, "can be imagined more graceful, or beautiful, than a cane bush—the ordinary cane of commerce. It often grows in extensive plots, but frequently in single plants, running up trees, and crowning them with graceful plumes." *

Canes, as we know, are used for all sorts of purposes, such as walking sticks, baskets, chair bottoms, and so forth; they grow to a great length, often to 200 feet and upwards, and every part of the plant is covered with terrible thorns, which make touching it in any way by no means an easy matter.

A remarkable thing about some of these canes is that they contain large quantities of clear, and quite drinkable water, so that when a section is cut out of the centre of the plant it sometimes gives off a cupful or more of good water. Canes generally grow best in moist, alluvial bottoms, adjoining rivers; and in these sorts of places they often form impenetrable thickets.

* *Thirteen Years among the Wild Beasts of India*, by George P. Sanderson, 2nd edit., 1879, p. 146.

The foliage of some of them much resembles that of the smaller bamboos, something in the style of that of our common lake reeds at home.

Before closing our remarks upon the subject of grasses, however, it is desirable to make a note of the fact, that although the splendour of tropical vegetation generally far exceeds that of the temperate zones, in the matter of pasture grasses, we find that the tropics can show nothing to compare with the evenly growing velvety carpet of succulent verdure which delights the eye in our English meadows.

The dwarf grasses which constitute our pastures are not only peculiar to the temperate zones, but confined to the colder portions of them, where showery, damp, inclement weather is prevalent. Nature thus displays a remarkable instance of that beneficent power which we so often find exhibited, of adapting herself so as to present some special advantage in each kind of climate, thus balancing inequalities, and supplying the needs of each particular country. In the warmer portions of the temperate zones, these grasses are coarser, turn brown, and wither away, under the influence of continued fine weather and brilliant sunshine; a superabundant moisture being necessary to their existence. In climates such as those of Spain and Italy therefore, these verdant meadows are comparatively rare. In Ireland, on the other hand, the vapour-laden breezes of the ocean, and the prevalence of a warm south-westerly wind, occasioning copious rains, specially favour the growth of grasses, thus obtaining for that country the well-earned soubriquet of "The Emerald Isle."

That being so, in the torrid zone, as might be anticipated, meadows such as we are accustomed to

in Northern Europe, are never seen, except at the commencement of the rainy season, when the tender shoots of the young grass first begin to sprout; and then it is only for a short time that this resemblance to the green pastures of the temperate zone is kept up: for although varieties of almost all our principal grasses have been identified as existing in almost every region, their habit of growth under a tropical sun is altogether changed; and instead of short, close, succulent herbage, gigantic growths of coarse, rank, broad-leafed grasses spring up. The now well-known Pampas-grass (*Gynerium Argenteum*), a recent importation from South America, which adorns many of our garden lawns, furnishes a fair example of this class of grasses (that is to say, it is a gigantic grass, which can be seen, and which will do fairly well, in our British climate—but it is in no sense a grass of the tropical zone).

We must now endeavour to give a short sketch of the characteristic features, special to the open or park-like region of the regular bush country, which in some respects are altogether distinct from those of any other region.

On account of the prevalence of the long dry seasons and powerful solar heats, the trees of what we have called "The Great Bush Country" are, as might be expected, except in well-watered situations, mostly dwarfed, stunted, and thorny—indeed on the African highlands, with the exception of an occasional gigantic Baobab tree (*Adansonia Digitata*) or a clump of Tamarinds or Sycamores (*Ficus Sycomorus*) * very few

* The Oriental Sycamore (spoken of in the Bible for instance) is quite a different tree to the sycamore (*Acer Pseudo-Platanus*) known in England, the latter being a variety of the maple—whereas the

large trees are to be seen. The traveller may in fact often continue his march for many days in succession, through extensive tracts of country, where nothing larger than the full-sized apple or pear tree of our English orchards are to be met with. This peculiar habit of growth, which causes these dwarf trees to bear a close resemblance to fruit trees, has often been the subject of remark among travellers. Doubtless to a certain extent it is due to the fact that as a rule the trees stand some distance apart, till sometimes they appear to be placed at regular intervals, almost as if planted by human agency. Generally therefore there is plenty of room for a horseman to ride at speed, or even for waggons to pass without any very special difficulty. Dense thorny clumps, wherever any traces of moisture exist, occasionally intermixed with trees of larger growth, are however by no means uncommon in some of these districts; and where these occur, they usually form thickets so dense, and bear such terrific thorns, as to be of an almost impenetrable character.

In these dry regions, evergreen forms are of course exceedingly rare, and when seen are mostly of the dwarf-palm tribe, and confined to low-lying districts adjoining the coast line or some great river system; but on the highlands of the interior the trees are almost exclusively deciduous; and in the hot season, as the

oriental sycamore is a true *fig*, and edible fruits are produced from racemes on the back of the larger branches, but not pendant to the twigs as in the case of the garden fig (*F. Carica*). The "*Sycamore*" fig is so called from the resemblance of its foliage to that of the Mulberry—and is really a purely greek word *Συκαμορος* or the Mulberry fig, from *Συκον* "fig" and *μορον*, "a mulberry"—(see *Encycl. Brit.* 9th edit. vol. ix. p. 154—Article "Fig").

vegetation becomes parched, the prevailing tint of the landscape is of a dull ashen hue, or sombre grey colour.

In the intervals between the bush, in the rainy season, abundance of succulent grasses and herbage springs up, often attaining a height of three or four feet or more, which then affords excellent pasturage for stock of all kinds; but as the dry season sets in, and these grasses ripen, assuming an appearance very much like ripe oats or wheat growing in an English corn field, they are then, however, apt to become exceedingly hard and wiry; spikes often forming at the ends of the stalks, which at such times renders travelling exceedingly disagreeable, as the sharp and sometimes barbed points inflict nasty wounds both upon man and beast. These spikes are also apt to break off, and fill the clothes of the passers-by with prickles, which soon make them unwearable. Stout leather leggings therefore in these districts become almost a necessity. Doubtless it is these, and other kindred difficulties, which have called into existence the curious, narrow, beaten footpaths, which exist throughout the whole interior of Africa. The long grass and thorny bush with which the wilderness is there covered, generally compel travellers to confine their wanderings to these well-worn tracks, the necessity for which thus at once becomes apparent.

The tremendous thorns with which the bush is armed, also seem to be a special characteristic of the bush country; these thorns are as a rule quite two to three inches in length, and often considerably longer. They are also stout in proportion, and of course capable of inflicting the most serious wounds. Many of

them have, in fact, all the characteristics of a nail. Those of the *Acacia Tomentosa*, for example, have earned the soubriquet of "The Jungle Nail." Indeed almost all trees of the mimosa and acacia tribe, which form a considerable part of the bush forests, are noted for their terrible thorns; and wherever their graceful plumes are seen, it becomes a species of warning to travellers to beware how they come into contact with them. Before quitting this "thorny" subject however, we may add that it has generally been supposed that Nature has almost universally armed the vegetation of this region with these formidable weapons as a protection against injury by animals, many of whom are tree-feeders, who live not so much upon herbage, as upon the leaves, shoots, and smaller branches of the arborescent vegetation.

In the first place bush feeding animals, like the camel, will eat up the thorns with the twigs, as if they did not exist. It has farther been pointed out by Dr. Hans Meyer, a well-known German traveller and botanist,—"that these thorns are not to be regarded as a defence against animals, so much as a protection against the drought of a dry season—which here often prevails in extraordinary intensity." Dr. Meyer explains that this is effected—"by partial suppression of leaves, which become indurated and form thorns, and these later on develop into branches, and give rise to other thorns; which shoot out from the stem alternately with the true leaves, and form a spinal, the extremity of each twig developing likewise into a sharp thorn. It is self-evident," he goes on to say, "that with such a suppression of foliage, there must be a corresponding diminution of transpiration, and the tree is thus enabled

to preserve its sap during the dry season, when its roots cannot any longer obtain moisture." *

A large proportion of this thorny bush, as we have said, is usually composed of various kinds of trees belonging to the Acacia tribe; and the intense heat and drought causes a shrinkage of the bark, in consequence of which cracks are formed, from which valuable gums exude and solidify.

This, in fact, is the great gum-producing country. Various species such as "*Acacia Arabica, A. Vera, A. Ehrenbergii,* and *A. Tortilis,* yielding the well-known gum Arabic"—while "the *Acacia Verek, A. Seyal,* and *A. Adansonii,* furnish a similar gum, known as gum Senegal"—also "the *Acacia Catechu,* and several other species yield catechu by boiling down the wood, and evaporating, so as to get an extract." †

These species are for the most part natives of Arabia, the East Indies, and Africa. Gum Arabic is collected in Northern Africa, by the Arab traders, in immense quantities.

"It begins to flow at the beginning of the dry season, which is generally about November, and the harvest lasts six weeks, during which time the collectors live almost entirely upon the gum, which is highly nutritious, six ounces of it being sufficient to support a man for twenty-four hours." §

In some parts of the country almost any amount of it may be collected. Sir Samuel Baker describing its

* *Across the East African Glaciers or the First Ascent of the Kilimanjaro*, by Dr. Hans Meyer, pp. 67—8. (Translated from the German by E. H. S. Calder, 1891).

† *Encycl. Brit.* Vol i, p. 63 (9th edit.).

§ Smith's *Dictionary of Economic Plants.*

profusion in the neighbourhood of the Stettite says that in December 1862

"there was a perfect exhibition of gum Arabic bearing trees. At this season" (he says) "the gum was in perfection and of the finest quality, in beautiful amber-coloured masses upon the stems and branches, varying from the size of a nutmeg to that of an orange—hard as ice on the exterior, but limpid in the centre, resembling melted amber, and as clear as though refined by some artificial process. The trees were perfectly denuded of leaves from the extreme drought, and the beautiful balls of frosted gum recalled the idea of precious jewels upon the trees in the gardens of the Arabian Nights." *

This gum was also exceedingly sweet and pleasant to the taste.

It is quite conceivable that some of these stories of enchanted gardens related by writers of Oriental romance, may have had their origin out of ideas created by scenes of this kind. The vast extent and desolation of these boundless wildernesses, the curious freaks of the mirage, and the extreme sameness of the landscape during the dry season, is, as the great Dr. Livingstone has more than once observed—"peculiarly conducive to meditation, and one is glad of any subject to occupy the mind, and relieve the monotony of the weary treadmill-like trudge-trudging." †

The romantic fancies with which the minds of nomadic peoples of the Arabic race are filled, are thus easily accounted for; while their belief in Genii, and other spirits of the waste, naturally causes their tales to be mostly coloured by visions of the supernatural.

* *The Nile Tributaries of Abyssinia*, by Sir Samuel W. Baker, 1867, pp. 336—7.

† *Expedition to the Zambesi*, by David Livingstone, 1865, p. 506.

Thus the mirage is often spoken of by the Arabs as *Bahr-Es-Sheitân*, that is to say the Sea, or waters of Satan.

When the long grass, with which many of these great tracts of bush country are covered, and among which the trees are dotted about, becomes desiccated by drought, it is usually the practice of the natives to set fire to it, with the double purpose of rendering travelling more easy, and of encouraging the rapid growth of young grasses, immediately the rains begin to fall, which then at once becomes the resort of game of every kind. And as might be supposed, when this is set on fire, the spectacle is often both grand and terrible; the whole country in fact frequently becomes, on these occasions, one mass of raging flame, the line of fire extending over a front many miles in breadth, through which it is wonderful that any vegetable substance can pass and still escape destruction.

Dr. Livingstone states that he has seen flames thirty feet high, shooting up into the air; accompanied by dense volumes of black smoke, while the atmosphere was filled with the charred remains of burnt grass, pieces of which were falling all around, as thickly as a shower of black snow.* The injury to vegetation is however not so great as might be supposed: the rapidly passing wave of flame merely singeing, without destroying, most of the trees; while the roots of the herbage remain wholly unaffected by it; and the ensuing rains immediately convert the bare and blackened surface into a fairy-like scene of exceeding richness and beauty. Nevertheless these annual fires undoubtedly

* *Expedition to the Zambesi*, by David Livingstone, 1865, p. 526.

exercise a great influence in preventing the natural formation of humus, or surface mould produced by the decay of vegetable refuse, and thus tend to impoverish and check the general improvement of the soil.

Where the bush, as is often the case, mostly consists of trees of the mimosa and acacia tribes, many of them are then covered with a profusion of deliciously scented flowers, for which these species are so justly celebrated; which together with their graceful feathery sprays of tender green leaves, and the verdant carpet of grasses shooting up all around, present a picture which is always most attractive.

Some of these trees, at this season, are positive models of natural beauty and elegance. Visitors to the South of Europe and the Italian lakes, for instance, will doubtless be familiar with one of the hardier varieties of the acacias, which is largely made use of as an ornament in the gardens there—we refer to the *Acacia Dealbata*, a native of Southern Australia, whose beautiful silvery gray bark, reddish brown twigs, and delicate pinnate foliage constitute a striking object in the shrubberies at these places, which at once arrests the attention. It is a tree which under favourable circumstances grows to a considerable size, and its bark (said to contain a larger percentage of tannin than any other)* forms a tanning substance which, if this plant were more largely cultivated, would doubtless prove of great economic value. It has of late years been largely cultivated in our South African colonies, in consequence. *Acacia Lopantha* is another lovely foliage plant, young specimens of which give a charming

* *The Commercial Products of the Vegetable Kingdom*, by Peter L. Simmonds, p. 405.

effect as a bedding plant in the London parks.

Then as regards the floral beauty and highly scented blooms of some of these trees, we may mention the well-known African species *Acacia Giraffa* as a good example, which during the rains is often to be seen covered with magnificent yellow flowers, which exhale an aromatic and overpowering perfume.* This tree which is largely distributed throughout Africa, is known in South Africa as the "Kameel Doorn" or "Giraffe Thorn"; it grows there to a great size, and forms a most valuable timber which is said to be harder than oak, and exceedingly strong and durable; it was in consequence highly esteemed for the axles of Cape waggons, and as such often proved a friend in need to the traveller throughout the South African wilderness. In Northern Africa, and in the Soudan, it is known to the Arabs as the *Soont*, and under various other local names.

The *Acacia Formosa* which supplies the valuable timber known in Cuba and the West Indies as "Sabicu"; the *A. Seyal*, supposed to be the Shittim wood of the Bible;† the *A. Melanoxylon* or "black-wood" of Australia, which attains a great size and is much used for furniture; and the *A. Homalophylla*, a fragrant timber known as "myell-wood" and used for ornamental purposes: all form valuable examples of the *Acaciæ*—of which it is estimated that there are about 420 species, widely scattered over the warmer regions of the globe.§ Trees of this family specially abound in Australia and Africa, and indeed over the whole of the

* *The Wild Sports of Southern Africa*, by Captain Cornwallis Harris, R.F., 3rd edit. 1849, p. 46.

† *Encycl. Brit.* Vol i, p. 68, 9th edit.

§ *Ibid.*, Vol. i, p. 68.

dry-hot climates in the Old World, while the Mimosa forms are more generally met with in the New. The latter are also more strictly confined to the torrid zone, whereas certain varieties of the Acacias flourish in the warmer temperate zones—and some forms will succeed tolerably well even in much colder climates. The sweet scent of the Mimosa blossoms, in the season of flowers, frequently fills the air with such an overpowering fragrance as to become disagreeable after some time. Even now, as we write of it, the powerful but somewhat sickly aroma of the mimosa-bloom, rises up in imagination to our nostrils, exactly as if we were still surrounded by the great wilderness of flower-covered shrubs, glowing in the resplendent brilliancy of a vertical sun.

The Mimosæ, so called from their mimicry of certain movements of animals, though exhibiting a great wealth and variety of species, amounting according to Bailou to 28 genera and 1100 species, are however of much less economic importance than the Acaciæ; but they supply very valuable tanning barks, that of the *Mimosa Decurrens*, a well-known Australian species, known there as the Black Wattle, being according to Professor Brandt, half as strong again as the best English oak bark. The Mimosæ are also remarkable for the exceeding beauty and delicacy of their bipinnate foliage, but still more, as the Encyclopœdia Britannica points out, because of the wonderful "sleep movements" which are exhibited by some of them.

THE SLEEP OF PLANTS is a natural phenomenon first discovered nearly a century ago, by the daughter of the celebrated Swedish botanist Linnæus, and though few people even now seem to be aware of the fact,

it is practically certain that the phenomenon of sleep is common to the whole range of both the animal and vegetable creation—as indeed are most of the leading vital functions of our frames, such as respiration, exhalation, circulation, nutrition, and even sensation; the latter however, of course only exists in a very minor degree in the vegetable creation. Plants are also created male and female, and are subject to many of the medical and even surgical diseases, common to man and animals. Thus plants suffer from improper food, sudden changes of weather, or draughts, and catch cold much as we do; and of surgical ailments it will be sufficient to mention tumours, warts, canker, and hemorrhage. It would however involve the discussion of details too long and too technical in their nature, to admit of going at any length into these subjects in these pages.

But as regards sleep, the fact will doubtless be familiar to most people that many kinds of flowers are in the habit of closing upon the approach of evening; we need go no further to seek for an instance in point than the common daisy, which is seen in numbers on almost every garden lawn. These little flowers may all be seen to close tightly up, as the sun goes down; to sleep fast throughout the night; and to awake again, and expand their flowers the following morning, under the influence of the solar rays. It was these movements that the learned Linnæus called "the sleep of plants."

It has however sometimes been supposed that they were caused by cold, and were that so, it would be a striking example of the existence of sensation in plants, to which we have already alluded; but this theory has

been disproved by the experiments of the elder De Candolle, the great Swiss botanist, who found that they were exhibited by plants enclosed in hot-houses where the temperature was constantly maintained at a fixed point, showing that these movements were due, not to cold, but to the abstraction of light*—they went to sleep in fact, much as the birds do, as Linnæus had said, upon the approach of night.

Louis Figuier, a learned French physician, only lately deceased, has given some interesting details upon this subject in his "Histoire des Plantes," and tells us that when the sleep of plants was first discovered, and when Linnæus saw "that this phenomenon could hardly be confined to a single plant" (such as the Lotus then under his observation) but must be "general throughout the vegetable kingdom"—he forthwith devoted his nights to the study of this question, with the result that "at every step he discovered fresh facts" in support of his supposition; respecting which, as Monsieur Figuier remarks, it may be asserted that "no natural fact once brought into notice has been so rapidly established by a host of confirmatory evidence" as was this curious function of sleep among the members of the vegetable creation. † Remarkable also is the additional circumstance first brought to light by De Candolle, that precisely as in the case of the young of both man and animals, to whom the amount of sleep necessary in infancy is greatly in excess of that required by adults, so also with young plants this phenomenon is

* See collection of reports to the "Institut National" of France, in the British Museum, "fait par les citoyens Thouin et Desfontaines sur un mémoire intitulé—'*Experiences relative à l'influence de la lumière sur quelques végétaux par le citoyen Decandotte.*'"

† *Histoire des Plantes*, by Louis Figuier, Paris 1865, pp. 109—112.

much more strongly marked than in older specimens, * seedling plants and babies being both remarkable for the length and soundness of their slumbers.

Now, in many of the Mimosæ, and in some of the Acaciæ, these sleep movements are specially clearly defined, for upon the approach of evening, their foliage is seen to become closely folded up, and to open again at sunrise on the following morning. A number of curious experiments were made by De Candolle with the sensitive plants (*Mimosa Pudica*, and *Mimosa Sensitiva*), and it was found that they could be put to sleep, like babies, almost at will, for plants removed from daylight to darkness quickly fell asleep—while others, exposed for several nights in succession to artificial light, and kept in darkness by day, accustomed themselves to their new conditions, "opening their leaves in the evening, and closing them again in the morning at the hour when their night commenced." In the case of other sensitive plants deprived of light altogether, it was found that the alternations of sleeping and waking still went on, but became very irregular. †

The sensitive plants, of which there are several varieties, as we know, are so called from the curious fact that they are exceedingly sensitive to anything touching them; and in Ceylon and some of the Brazilian forests, where the Mimosa Pudica is a common weed, many square yards covered with these plants may be seen instantly to shrivel up, exactly like a living creature in pain or fear, when anyone treads upon its

* *Histoire des Plantes*, by Louis Figuier, p. 109.

† *Ibid.*, p. 112; see also *Encycl. Brit.* Vol. xvi, p. 345, 9th edit., article "Mimosa."

tendrils. Even the vibration of vehicles passing along the road near one of these extraordinary plants is sufficient to cause it to close its leaves, as if alarmed at the approach of a possible foe. We have often amused ourselves with experiments upon the nervous system of the Sensitive Plant. The "Mimosa Pudica" is a pretty object everywhere in the countries where it flourishes; and on dry banks fully exposed to the sunlight, spreads itself like a carpet closely over the ground, which it often completely covers with its tendrils. Its delicate pinnate foliage is of a very dark, almost olive green colour. The leaves are very small, and at certain seasons it bears numerous pretty little pink balls of flowers.

If a stick is somewhat roughly drawn across a patch of it, or if it is gently beaten with a wand, whole square yards of ground may be seen to suddenly change colour, through the sudden closing up of the leaves—which shrivel up into almost invisible shapes of a brown, earth-like shade (such being the colour of the under part of its foliage), and the ground appears thus, as it were, instantaneously bereft of herbage. The effect is a most curious one to witness. Finally, we may remark that this plant carries out this operation on its own account the moment that the shades of evening approach, and remains thus tightly closed up throughout the entire night. The little sensitive plant thus affords one of the best examples of "the Sleep of Plants."

Many curious facts respecting these and other kindred subjects might be added, but we must pass to the consideration of other matters more directly connected with the characteristic features of the Bush region.

Among the most remarkable of the vegetable products of this open steppe region, the gigantic Baobab (*Adansonia Digitata*) deserves at least a few words of passing notice. The range of this curious tree extends over the whole of tropical Africa, wherever tracts of bush country (of which it is essentially a habitant) occur to furnish locations suited to its peculiar habits: for as we have already intimated, such situations, as for instance dry, elevated highlands, are found here and there throughout Equatorial Africa, where the Baobab seems to flourish as freely as in the vicinity of the tropic, which appears to be its natural home. *

This remarkable tree which belongs to the family of the *Malvaceæ*, was first brought into notice, about 1749, by the French naturalist Michel Adanson, after whom it has been named, and by whom some gigantic specimens were discovered on the Senegal River; some of which were estimated by him to be upwards of 5000 years old †: a result which he obtained by comparing them with the size of smaller specimens whose age was ascertainable by sectional cuttings of their stems. There can be no doubt that these strange misshapen trees are not only among the most long-lived, but also among the most ancient (according to Humboldt, the German philosopher, probably *the most* ancient) of all known species of arborescent growths; and the Boabab is in all probability a relic of the vegetation of the primeval world, transmitted to us through periods of immense antiquity.

The peculiar torpid habit of growth of these vege-

* A pair of fairly good specimens of the Baobab are to be seen in the Botanic gardens at Bombay. These are of course small trees but give a good idea of the habit of growth of the larger natural specimens.

† Smith's *Dictionary of Economic Plants*, 1882.

table monsters, whose natural habitat are the intensely dry, stony, almost waterless tracts of Bush Region, where the annual period of growth is generally restricted by drought to a very short part of each year —naturally contributes to spread their term of existence over long periods of time, during which the tree stubbornly continues to put forth its little tuft of leaves during the short rainy season, and then relapses into its apparently lifeless state for the remainder of the year; and thus it comes that the learned Baron von Humboldt considered them "the oldest living organic monuments of our planet" *—for in endorsing the conclusions come to by Adanson respecting the great trees described by him, Humboldt remarks: "they would date back to the times of the builders of the Pyramids, or even to Menes, an epoch when the constellation of the Southern Cross was still visible in Northern Germany." †

An old Baobab therefore forms, as might be expected, a striking and venerable object, which is generally visible from a great distance in the landscape, whose vegetation mostly consists, as we have already shown, of dwarf and thorny mimosæ. "One must in fact have seen and contemplated this giant of the vegetation of the tropics to obtain an idea of it—one imagines oneself dreaming on seeing it." § Thus the French traveller, Comte D'Escayrac de Lauture, speaks of the Baobab.

It has been a general subject of remark among

* Quoted in Smith's *Dictionary of Economic Plants*, 1882.

† *Ansichten der Natur*, by Alexander von Humboldt.

§ *Le Désert et le Soudan*, Etudes sur l'Afrique du Nord, par Monsieur le Comte D'Escayrac de Lauture, 1853—p. 77 (Translated from the French).

travellers that a young Baobab is rarely or never seen. It may be that this is due to want of observation, or because these small specimens are not at first sight easily recognized as of the same species, for in the collection of Economic Plants at Kew Gardens, we have been informed, no difficulty has been found in propagating it.* The remarkable feature about the old tree is, however, its short gouty stem, entirely disproportioned in its immense girth to its height, sometimes more resembling a huge cask than a tree trunk; while its branches, which seem to form a mere tuft at the top of some of the older trees, are few in number, yet massive as its stem; and of course, for reasons already pointed out, the tree is rarely seen in leaf. The leaves themselves, however, when in being, are "digitated" like the fingers on a man's hand, and somewhat resembling those of the horse chestnut, while its wood is said to be soft, and not much firmer than cork, and succulent as a carrot." †

Sir Samuel Baker gives an interesting description of some of these grand trees, growing along the course of the Settite River of Abyssinia, in a wild and rugged district, where the scenery was "just like an English park, with no larger timber than thorn trees," save and except these great baobabs and the Tamarind (*Tamarindus Indica*), another of the splendid vegetable treasures peculiar to this region, concerning which we must find time presently to add a few details. Sir Samuel Baker measured one of these Baobabs, which he says

* Count D'Escayrac de Lauture, however, states that small seedling Baobabs are common in Kordofan, but that it was most difficult to form any idea of their age. See his *Le Désert et le Soudan*, p. 73.

† *The Nile Tributaries of Abyssinia*, by Sir Samuel W. Baker, 1867, pp. 355—6.

was 51 feet 1 inch in circumference.* From South Africa Mr. Chapman tells a similar tale: "We were lost in amazement," he says, "at the stupendous grandeur of this mighty monarch of the forest;" another Baobab, whose dimensions, taken "with a measuring tape, showed its circumference to be at the base 29 yards." † That of course would give it a diameter of some 27½ feet. Generally, as we might naturally expect, these immensely ancient specimens are hollow in the heart, cavities of a very extensive nature being often formed, some of which are so capacious, as to afford a dwelling-place for parties of wild and wandering natives, who occasionally take up their quarters there. These hollows are also frequently found to become filled with water during the rainy season, thus forming a most efficient natural cistern, where the precious fluid, being well shaded from the sun, is often preserved in considerable quantities throughout the dry season. According to the well-known French traveller, Count D'Escayrac de Lauture, a great authority on desert travelling, these vegetable cisterns are found to exist in considerable numbers in the Soudan, where they are turned to profitable account by the natives, when water is scarce.§ The hollows in some of these trees are, he says, so extensive, that they have been known to hold as much as 20,000 gallons, which were stored up in the heart of a single tree. **

The fruit of the Baobab, which is contained in a

* *The Nile Tributaries of Abyssinia*, by Sir Samuel W. Baker, 1867, p. 376.

† *Travels in the Interior of South Africa*, by James Chapman, 1868, Vol. i, p. 62.

§ *Le Désert et le Soudan*, par M. Le Comte D'Escayrac de Lauture, p. 76.

** *Ibid.*

brittle shell five or six inches or more in length, containing seeds and pulp, something similar to that of the Tamarind, affords a grateful and refreshing sub-acid substance, highly valued by travellers, and when mixed with sugar and water it makes a very pleasant drink *— and finally a decoction of its bark has been found to possess properties similar to quinine, and in case of necessity has been used as a more or less effective substitute for the latter. † We fear, however, that we have not sufficient data to speak more decidedly on this point; we should therefore be glad to hear that the medicinal virtues of this bark had been given a fair trial.

Some doubts, we think it right to state, have been attempted to be thrown upon the supposed great antiquity of the giant specimens of the Baobab, to which we have already alluded; and we understand that this tree has been quite naturalized in the northern part of Ceylon, where observations collected upon its growth are said to show, that the estimates of its age given by Humboldt, who speaks of it as "the oldest organic monument of our planet," are "altogether fallacious," and that "the Baobab is now well known to be a very fast-growing and short-lived tree." §

On this head, we shall merely observe, that trees and plants are very often known to completely change their entire nature and habits, by transplantation to a foreign soil and climate. Of this fact, numerous instances could easily be quoted, and nowhere more

* *Travels in the Interior of South Africa*, by James Chapman, Vol. i, p. 62.

† *Pharmaceutical Journal*, Vol. viii, p. 89 (1848).

§ Sir J. Hooker—quoted in Catalogue of Trees etc. at the Royal Botanic Gardens, Ceylon, by D. Morris, Assistent-Director, published at Colombo, 1879 (by Government Authority), p. 74.

readily than in Ceylon, where there are many striking examples of it; for instance the peach and other trees of the temperate zone have there turned into evergreens. That the Baobab may have *become* "a fast growing tree" in Ceylon, need not therefore surprise us. It merely proves that it is one of those trees whose nature has changed upon its introduction into that island, and in consequence we are not at all surprised to hear that it is there "a short-lived tree." But the improbability that these gigantic specimens of it should be so also, in the dry desert regions spoken of by Sir Samuel Baker and others, must strike every thoughtful mind. There, though there is a season of luxuriant growth, its very shortness would render the existence of fast-growing trees impossible. Moreover, all the desert trees and shrubs, so far as we know, are distinguished by a peculiarly slow and dwarfish form of growth: as evidenced by their compact appearance and the shortness of their twigs. We therefore still believe the views of the distinguished German philosopher Humboldt to be correct, and that those of his modern commentators, in this instance at least, have been arrived at upon insufficient and fallacious data.

Another of the magnificent productions of the dry regions of the bush country is the Tamarind tree (*Tamarindus Indica*), which we feel we ought by no means to pass over without a few words of notice. It is, as its name denotes, indigenous in our Indian Empire (but it is also widely spread over other regions, in Africa and elsewhere, in general strictly within the Tropical Zone), and to our mind there forms one of the chief glories of its botanical treasury. Sir Samuel Baker, for instance, considered it one of the handsomest trees

in the Tropics;* and for ourselves we may say we have never tired of admiring the venerable beauty of some of these great Indian trees, whose age must certainly be numbered by many hundreds of years. It is unfortunate that history rarely enables us to fix the ages of trees; the most that it generally enables us to do is to find certain specimens made mention of at some distant era in the past, when they were already noticed, not as young, but even then as aged trees, venerable and striking for their majestic appearance. The biographer is then sometimes, but alas! on but rare occasions, constrained to mention them in his writings.

We fear we are not in a position to say where the finest and greatest of such trees are to be found; Sir Samuel Baker mentions one growing in Ceylon nearly forty feet in circumference, with branches covering nearly half an acre of ground;† near the Sacred City of Benares also are many splendid specimens, and at Allahabad (the present capital of the N.W. provinces) there is, among others, a specially fine tree in the garden of the "Khusru Bagh," which was occupied as the head-quarters of Lyakut Ali, the leader of the Allahabad mutineers in 1857.§ This tree measures 28 feet in circumference, and has an immense spread of branches. The Tamarind is at all times a tree of singular beauty, and is also evergreen, bearing some resemblance in leaf and colour to a gigantic yew-tree, but the foliage which is much more soft and feathery is of a lighter green and grows very close and thick,

* *Eight Years in Ceylon*, by Sir Sam. Baker, 1855, p. 262.

† *The Rifle and Hound in Ceylon*, by Sir Samuel Baker, 1854.

§ This man was known as "The Moulavie"—by caste a weaver, by trade a schoolmaster, but really a religious fanatic and pretender to Royal descent.

so that on the hottest days it casts a large circle of umbrageous shelter around it: admirably fulfilling the conditions pictured in these beautiful lines of Byron, descriptive of pilgrims resting under the shade of ancient trees:

"Here, in the sultriest season let him rest:
Fresh is the green beneath these aged trees.
Here winds of gentlest wing will fan his breast,
From Heaven itself he may inhale the breeze.
The Plain is far beneath; oh! let him seize
Pure pleasure while he can: The scorching ray
Here pierceth not, impregnate with disease.
Then let his length, the loitering pilgrim lay,
And gaze untired, the morn, the noon, the eve, away." *

Though these lines were descriptive of a scene in far other climes than the plains of India, they stand prominently forth as an admirable picture of clumps of this noble tree, as they are found growing there, with restful groups of white-robed natives reclining beneath their shade, when in the hot season an incandescent sun scorches the surrounding plain with rays of fire. † The Tamarind is regarded by Orientals peculiarly a tree of the East, and of India in particular, for both in the Arabic and the Persian, it is known as the "Tamar-El-Hind," from which its European name is evidently taken. Another fine description of just such another picturesque scene, is found among the numerous striking and dramatic allusions to oriental life, which we find so frequently made use of throughout

* Lord Byron's *Childe Harold's Pilgrimage*, Canto ii, Stanza 50 (N.B.—This scene is laid in Greece near the convent of Zitza).

† Among some of the Indian Natives, however, the Tamarind is regarded as an unhealthy tree to camp under.

the Scriptures. It is taken from the book of the Prophet Daniel—

"I saw, and behold a tree in the midst of the Earth, and the height thereof was great. The tree grew and was strong, and the height thereof reached unto Heaven, and the sight thereof to the end of all the earth. The leaves thereof were fair, and the fruit thereof much: and it was meat for all: the beasts of the field had shadow under it, and the fowls of Heaven dwelt in the boughs thereof, and all flesh was fed of it." *

It would be difficult for any word picture to convey a finer idea of a group of giant trees, rising out of the boundless flat surface of a great plain, such as that of Northern India; such specimens are here seen afar off, upon the distant horizon, towering towards heaven, and are visible for miles in every direction; literally in this case "to the end of all the world," that is to say, for five or six miles, to the limits of the terrestrial horizon. We can have no doubt that such is the interpretation to be put upon this passage, which thus read would be strictly correct. Such trees form a grateful spectacle at all times, to break the monotony of the landscape, and may often be seen thus rising upon the boundaries of the horizon, which the contour of the earth's curvature here limits to a man travelling over its surface, somewhat to the distance we have indicated above.

Upon the great plains of India such groups of trees generally consist among others of trees of the Ficus tribe, such as the Banyan (*Ficus Indica*, Linn.), the Peepul (*Ficus Religiosa*), or the Tamarind (*Tamarindus Indica*), and in some places of the various Bombaceæ, especially

* *Daniel* iv, 10—12.

the Red Cotton tree (*Bombax Malibaricum*, Linn.)*; but it is evident that the Scriptural description would apply with peculiar force to the Tamarind, whose "fruit was much" and "meat for all," for none of these other trees, though all of them are splendid examples of arborescent grandeur, produce good fruit of an edible nature. The value of the tamarind in this respect is well known; its fruit grows in white, hard-shelled pods, four to six inches long, something like French beans, which contain, when fresh, seeds and a delicious sub-acid pulp, very grateful to the palate in hot weather. They are consequently much sought after by monkeys and other creatures, as well as by man.

Sir Samuel Baker in his "Ismailia" mentions the existence of extensive forests of magnificent tamarind trees within the equatorial zone near Gondokoro, on the White Nile, and he mentions that there is one of these trees about a mile from the station beneath which 1000 cattle might find shade;† he also speaks strongly of the value of its fruit to travellers:

"By taking off the shell and pressing the tamarinds into lumps of about two pounds weight" (he says) "they will keep in this simple form for many months, and are invaluable in cases of fever; and (used medicinally as a drink) are cooling when drunk cold and sudorific when taken hot; if taken in large quantities they are aperient." §

Among the great trees which we have just men-

* There are also many groves of other trees, as for instance the Mango (*Magnifera Indica*) in the Indian plains, which are also very fine, but not to be compared in size with the great trees here mentioned as of the first magnitude. The Babul (*Acacia Arabica*) is another very fine tree often seen on the Indian plains, which grows rapidly in favourable situations and forms a striking object in the landscape.

† *Ismailia*, by Sir Samuel W. Baker, 1874, Vol. i, p. 231.

§ *Ibid.*, Vol. ii, p. 557.

tioned as adorning the Bush Region of the Indian plains, the Banyan has been already described in our chapter on the equatorial zone: and as regards the Red Cotton tree (*Bombax Malibaricum*) we may state that, according to Balfour, it is very common in the Bombay Presidency, * and there forms a stately tree, often 80 to 100 feet in height to the first bough, in favourable situations. When large it has buttress roots, and the trunk is covered with sharp spines. It sheds its leaves in spring, and the leafless branches are then seen covered with a mass of large scarlet flowers, shaped like those of the magnolia. At this time it therefore forms a most striking object in the landscape, and after flowering it produces great pods of a substance like white cotton, which blows all over the surrounding country like dandelion-down at home; but it is only useful for stuffing cushions and other common purposes. The geographical range of this tree is very great, and it may be regarded as a habitant of almost the whole extent of the tropical zones. And last but not least, the Bô-tree (*Ficus Religiosa*), already mentioned, which is called the Peepul all over India, resembles a gigantic poplar in habit and foliage; its leaves also rustle in the wind like those of an aspen. It too has a wide geographical range of growth, and like the Red Cotton tree it is seen from Ceylon, all over Hindostan as far as Peshawar on the Afghan frontier. It therefore stands cold weather perfectly, indeed some of the finest specimens we have seen were growing on the banks of the Ravi, near Lahore. In the gardens of the Taj, at Agra, the visitor may also see this tree

* *Cyclopedia of India*, by Surgeon-General Edward Balfour, 3rd edit., 1885, Vol. i, p. 407.

in its character of "parricide"; that is to say, where a seed of the Peepul has lodged in the fork of another tree, has there germinated, and cast down long air-roots which run down the parent trunk; reaching the ground they take root, and the Peepul is then seen in the process of squeezing the parent tree to death, as a boa constrictor is said to strangle an animal enfolded in its coils. When this has been effected, we have seen several cases where the Peepul remains standing aloft a magnificent tree, with a hollow cylinder in its heart marking the form of the original tree, which once occupied that situation, but whose dead trunk has long since turned to dust, upon which the more vigorous parricidal growth has fed and flourished.

Elsewhere we have described the seeds of this remarkable tree as effecting the destruction of buildings and other works of man. The visitor will see many examples of its power in this respect, throughout the Bush Region, among the ruins of any of the ancient cities of India, as well as in the equatorial zone, where the action of this tree has been already discussed in that capacity.

Passing however from the region of the larger arborescent growths, we must turn our attention to the smaller growths of the dry bush-covered plains, which adjoin our next division, the Desert Zone. The class of trees and plants here found existing are mainly formed by Nature to be essentially drought-resisting. There are many wide areas of country, which are fertile and well-watered during portions of the year, but completely waterless at other seasons. The great Kalahari Desert in South Africa is a notable instance in point. This enormous territory contains a large area

of admirable pasture land, and a good deal of heavy bush country, but it is subject to this fatal defect, that during the long dry season its pools dry up and it becomes perfectly waterless; even the game animals, excepting a few well-known kinds, who manage to exist on the sap of plants, being compelled to abandon the district till the return of the rains. A good many cases have occurred where unwary travellers, who had allowed themselves to get caught by the drought, have perished in this great "thirst land," while the sufferings undergone by others, who eventually succeeded in escaping, have been extraordinary. These casualties moreover seem to be even more common in these occasionally well-watered and fertile districts, than in the absolutely sterile regions of the Desert Zone.

Mr. A. H. Bryden in describing the Kalahari, which we have selected as a good typical example of this description of territory, says—

"During the brief weeks of rainfall no land can assume a fairer or more tempting aspect the long grass standing succulent, and elbow-deep; flowers spangle the Veldt in every direction; the giraffe acacia forests, robed in fresh dark green, reminding one of nothing so much as an English deerpark; the bushes blossom and flourish; the air is full of fragrance; and pans of water lie upon every hand. Another month and all is drought: the pans are dry again; the grasses are turning to their winter yellow, and travel is full of difficulty." *

In the above paragraph the treacherous nature of this class of country is well portrayed, and it must be

* *Gun and Camera in South Africa*, by H. A. Bryden, 1893, p. 141. [The Acacia giraffe here spoken of, is merely a variety of the well-known, and widely distributed *Acacia Arabica*, which we have noticed on p. 307 as being known in India under the Hindi name Babul].

evident how easily a traveller trekking with waggons across such a territory, might be overtaken by the drought; although the fine tree vegetation of entire districts tells us in silent, but almost unmistakable terms, that though the surface waters may have disappeared, stores of the precious fluid still exist not far beneath. Such in fact, has actually been proved to be the case in many parts of the Kalahari; for where water has been intelligently sought for, and wells sunk during the fertile season, an abundant and, we believe, never failing supply has been found in several places at a very moderate depth; so much so, that there is a very general expectation that the day is not for distant when many parts of this redoubtable "desert" will be inhabited by stock farmers, whose wants will be supplied by wells, assisted, in all probability, by the construction of reservoirs. In many dry, so-called deserts in Australia this has already heen effected, and we have been informed that some of the finest sheep runs are now situated in such localities, that is, where surface water was formerly entirely absent for a considerable portion of the year.

It is a fortunate, and indeed a wonderful dispensation of Nature, that cattle and other stock bred on dry plains can go without water, in a way that would be deemed impossible in more favoured lands. For instance in the regular deserts of Northern Africa, Count D'Escayrac de Lauture, a great French authority on such matters (who had immense experience of desert travelling and the habits and customs of the desert tribes), assures us that it was the regular custom of the desert Arabs not to give their animals daily drink, but "to take the sheep every second day to

the wells; the cattle every third day, and the camels every fourth day." * In the very hottest and driest weather, however, they water them somewhat oftener, "while during winter, they go more rarely, and from the commencement of the rains it is no longer needful for them to be taken there." †

In South Africa also, the cattle reared by certain Kaffir tribes inhabiting dry Karoos, are said not to require water more than once in two days, at any time: whereas cattle bred in well-watered districts of the temperate zone, seem to require water at least twice a day—or say morning and evening. It is also certain that in some of the Karoo districts cattle and especially sheep and goats, can live upon the succulent Karoo bush for considerable periods without drinking; these dwarf tufts of bush, notwithstanding their dry and uninviting appearance, being so full of sap, that they seem to take the place of the Swedish Turnip on English farms for stock feeding; but when these succulent plants begin to wither of course it will necessitate the cattle at all events, being removed to places where there is water, and probably the sheep also.

Mr. H. A. Bryden, a member of the South African Committee, writing on this subject says:—

"The Karoo vegetation despite its parched-up appearance is so succulent that the flocks can without inconvenience do without water. It may be astounding to the uninitiated to learn that in South Africa, of all places in the world, animals can live and thrive, for long months, upon pasture absolutely waterless: yet such is the case." §

* *Le Désert et le Soudan*, par le Comte D'Escayrac de Lauture, 1853, pp. 286—7 (translated from the French).

† *Ibid.*, p. 287.

§ *Kloof and Karoo*, by H. A. Bryden.

Sheep, goat, and ostrich farming we ought to say, is here principally alluded to. There can be no doubt that the great curse of South Africa is want of water, and the heavy and serious losses of stock, occasioned to farmers in those countries by drought, is unfortunately but too notorious, notwithstanding all the precautions that can be taken in shifting them and providing permanent watering places. Oxen however, can subsist, in case of need, for what to us would seem surprising periods without drink, even under the strain of constant work. Nearly every African traveller has his own tale to tell of experiences he has had to undergo in this respect, and two or three days of almost constant marching, has undoubtedly frequently been done in the thirst districts, without water, and with comparatively little loss, provided the animals get a good rest, and plenty of water after it. Even four days has been done. Mr. Bryden for instance, a recent authority on such matters, assures us that during his journey across the Kalahari desert—"although we had two days and nights without water, and in the middle of the desert, two days and three nights, and three and four nights without a drop of water for the cattle, we only lost one ox: our oxen were, however, terribly enfeebled." * A trader who followed in the rear of Mr. Bryden's party, however, is stated to have lost "many oxen from thirst and exhaustion." † But herbage was at the same time always plentiful, for throughout these dreary and waterless wastes almost everywhere, according to Mr. Bryden, grass is

* *Across the Kalahari Desert to the Botletli River, N'Gamiland*, by H. A. Bryden in Longman's Magazine for Sept. 1891, p. 524.

† *Ibid.*, p. 523.

good, and capable of supporting cattle, if only water could be found. This constant permanence of good grass, and especially of fine timber—which we have been assured by an ex-trooper of the Bechuanaland Border Police, who had been all over this country, is to be found in many places, in what is called the Kalahari desert—is however of itself as we have said, in our opinion, an almost certain indication of water at no great depth below; the deeply penetrating root fibres of these desert trees and grasses being undoubtedly nourished by the evaporation of water, exhaled through the soil, which thus, where all is otherwise dead, still preserves the verdant charm of Nature over large districts of apparently waterless country, thus almost recalling the well-known apostrophe of Romeo over the inanimate form of Juliet, whose features still appeared overspread with the bloom of youthful life and loveliness—

> "Death that hath suck'd the honey of thy breath
> Hath had no power yet upon thy beauty.
> Thou art not conquered; beauty's ensign yet
> Is crimson in thy lips, and in thy cheeks,
> And death's pale flag is not advanced there." *

As regards the penetrating power of roots it is worth observing that on the borders of rivers, where the stream has undermined the banks and caused falls of earth, we may in fact constantly see for ourselves how very far down these fibres will sometimes penetrate into the ground in search of the life-giving fluid. This peculiarity may be said to be common to almost the whole of the arborescent vege-

* Shakespeare's *Romeo and Juliet*, Act v. Sc. iii.

tation of very dry countries, where drought is constant for the greater part of every year. So also with some of the grasses; they will thus penetrate the soil of such localities to extraordinary depths with hair-like rootlets, resembling delicate threads. The desert Halfa, or Esparto grass (*Stipa Tenacissima)* for instance, will do so; so also in our own country, will the well-known "bent" or pea-reed grass (*Arundo Arenaria*) which grows on pure sand dunes near the sea-side. There really seems no practical limit to which we can say this grass, and another, *Elymus Arenarius*, usually found with it, will not penetrate through sand. The extraordinary depths to which it can sometimes be seen to do so where falls have occurred in sand cliffs, almost exceed belief.

Mr. Doughty, an English traveller, who had years of experience of desert life among the wild Bedouin tribes of Arabic deserts, has come to conclusions identical with our own in the matter of tree life in very dry regions, in connection with the existence of subterraneous stores of water. These opinions he probably formed from information acquired among the Arabs, who are keen observers of Nature. "Everywhere," he says, "we see some growth of Acacias, signs doubtless of groundwater, not far under——" *

We have gone at some length into these matters, because of what we conceive to be the great importance of coming to a right understanding about such questions in our South African and Australian colonies. At the same time the necessity of caution in venturing into thirst lands is so evident, that we make no apology

* *Arabia Deserta*, by Charles M. Doughty, 1882, Vol. ii, p. 462.

for concluding this branch of our subject by a further quotation from the pen of Mr. Bryden.

"Although in the last few years" (he says) "travellers and hunters have crossed the Kalahari, and wandered hither and thither, very little is known of the country, even in adjacent South Africa.—The spaces are so immense, the surface waters so scant, and the danger of death by thirst and starvation so imminent: that extreme caution has to be exercised.—Let no man, unless he wishes to leave his bones in some dreary waste, or lone forest, attempt to exploit the Kalahari, without the best of guides, and the advice and good offices of local chiefs." *

In most of these dry regions, where the waters become exhausted during the period of the droughts, there are generally remote pools and fountains among the hills where permanent water exists, which are known only to the native residents, who have discovered them in the course of their wanderings, by watching the movements of game animals and birds, which are known to require to drink daily; where these creatures are to be met with, it may of course be taken as a certain indication that the means of quenching their thirst are to be found within comparatively moderate distances. Water can also frequently be discovered by following the recent trails or paths of such animals, which will frequently lead the traveller directly to springs and other sources of water-supply, which would otherwise certainly be overlooked.

It requires an experienced eye and a good judge, however, to tell the exact age of the tracks; for it is obvious that an old trail may lead the traveller on a bootless errand to water pools which have already

* *Gun and Camera in South Africa*, by H. A. Bryden, 1893, p. 144.

become dry. Sometimes, however, by sinking a hole in the beds of these places, a certain quantity of water may still be found—sufficient perhaps to suffice for immediate wants.

But as regards the critical operation of seeking for, and finding water on these occasions, the various expedients that have been resorted to by travellers would occupy too much space to enable us to do justice to such a subject here.

Leaving therefore the question of the water-supply, let us confine our attention to the vegetation in these districts, when they have become, it may be, almost waterless, until the return of the rains.

It is remarkable, that except in barren tracts of actual desert, throughout the Bush Country proper, there are usually at all times, fair, and often ample resources, in the way of dried grasses, for pasturage purposes: long grass in the fertile and low-lying districts; and short grass upon the high plains and barren lands. The herbage of these latter very generally consists of grasses containing much nourishment in small bulk, and possessing qualities which render them, though they may be coarse in appearance, invaluable as forage plants. So that travellers whose cattle may have suffered materially in condition while crossing the barren sandy tracts, usually find their animals rapidly pick up flesh when they enter the bush region, if only water can be found.

The whole experience of the Australians goes to prove the accuracy of this view; large areas of country long regarded as "irreclaimable desert" having been already converted into highly profitable cattle ranges, in different parts of Australia, by the simple expedient

of constructing reservoirs for the water which falls in ample abundance during the rainy season. And moreover experience shows that the constant presence of large herds of cattle upon the ground, and the ceaseless tread of their myriad hoofs, brings about a sure, though gradual change in the land, by causing the soil to become firm and hard, whilst fresh growths of valuable grasses follow the footsteps of the invading herds.* These are remarkable facts, strongly confirmed by the curious circumstance that many of the game animals inhabiting "the thirsts," or waterless districts, of the Kalahari, are generally found to be fat, and in excellent condition, when shot.—Mr. A. H. Bryden, in an article in Longman's Magazine, makes special mention of this fact, and states that "All the game of this region thrive even to fatness: elands, gemsboks, giraffes, the duiker and tiny steinbok, all flourish. A giraffe shot in a quite waterless country was fat, and elands shot in the very heart of the 'thirst-lands,' were all in magnificent condition, quite equal to well-fed cattle, which in bulk and appearance they somewhat resemble, true antelopes though they are." † These facts are confirmed by the observations of many old hunters and travellers.

There are certain game animals, such as those just mentioned, which can subsist for long periods upon herbage only, provided it is juicy and succulent, or even upon dry grass, if dew falls in reasonable abundance. Now it is remarkable that it is exactly in these

* See *The History of Australian Exploration from 1788 to 1888*, compiled from State documents by Ernest Favenac, Sydney, 1889, pp. 40 and 41.

† *Through the Kalahari Desert to the Botletli River, N'Gamiland*, by A. H. Bryden, in Longman's Magazine for Sept. 1891.

dry regions that the vegetation is of a peculiarly succulent character: the storing up of juices in its fibres being doubtless an effort of Nature to enable these plants and herbs to resist the long and trying droughts. Without some provision of this kind, the great probabilities are that they would dry up and finally perish; but as we shall show in its proper place, in our following chapter, the true deserts themselves are generally full of succulent bulbs and dwarf fleshy-leafed bushes, which supply the place of water wherever there is vegetation, and so certain animals are enabled to maintain existence in districts entirely deprived of surface water. The vegetation of the South African Karroos is full of instances of this kind.

But this peculiar organization among certain animals, enabling them to do without drinking under such circumstances, is by no means entirely confined to dry regions, though there, of course, the most remarkable instances of it are found. In our own country, as we know, the rabbit will do in fields where it cannot get to water; and the mouse in houses and other dry places, where not even green food is obtainable. So also sheep upon most English farm lands, if in good health, rarely require to drink water; the dewy succulent meadow grass is quite sufficient for them. In dry countries like South Africa and Australia, however, where the herbage becomes desiccated, all animals require to visit the water springs regularly.

There are, as we know, many animals, like the horse for instance, that require water at least twice in the twenty-four hours. So also among game animals there are certain species which are never found far from water; when therefore the streams begin to dry up,

in certain sections of country, these animals fly before the drought, and migrate to well-watered districts, or collect upon the banks of large rivers whose sources are perennial. The Chobé and the Zambesi in South Africa, are instances in point: these, and other great waters being visited, at certain seasons of the year, by countless thousands of game animals, driven thither by thirst from the waterless plains. The hippopotamus, of course, being an aquatic animal, never quits the immediate vicinity of water. The rhinoceros also requires to drink daily, and never strays far into waterless tracts. So also, according to Dr. Livingstone, the zebra, the pallah, and the buffalo, are never found any great distance from water; and the spoor of all these animals, freshly made, may be accepted as certain evidence that water is not far off. Again, the same high authority remarks that when, amidst the solemn stillness of the woods, the singing of joyous birds falls upon the ear, it is certain that water is close at hand.* Blessed therefore to the traveller's ear are these musical sounds in a thirsty land.

Similar evidence is afforded by watching the converging flights of birds as they pass towards evening in the direction of their drinking places. Mr. Gordon Cumming, the great African hunter, for instance, saved his expedition from a disastrous retreat by noting the flight of birds. His cattle were perishing from thirst, and treacherous guides were urging him to go back, because the country in front, which they did not want him to see, was, they asserted, a wide waste of waterless desert, which no man had ever been through; but

* *The Zambesi and Its Tributaries, and the Discovery of Lakes Shirwa and Nyassa*, by David and Charles Livingstone, 1865, pp. 207—8.

the sagacious hunter was too thoroughly skilled in the signs of the wilderness, to be taken in by such alarmist rumours, and insisted on continuing his march, and on riding in the direction from whence the returning flights had come, he soon found a pool of excellent water, sufficient for all his wants.* This anecdote speaks volumes as to the high importance of travellers through wild countries observing the habits and characteristics of the birds and animals, and becoming close students of Natural History. Nor is careful observation of the vegetable productions of a district one whit less important, for they too furnish irrefragable evidence as to the climate, the nature of the soil, and the whole character of the country generally.

In Australia, for instance, there are certain sorts of grasses that are never found except in waterless districts; of these the prickly Spinifex (*Triodia Irritans*) is a good example; the early explorers all remarked that wherever much of this grass was found growing, the district was sure to be dry, and often wholly bereft of water. Other herbs indicate that the soil is salinous, and that water, should it exist, is salt or brackish, and so on: we might write quite a chapter upon such matters only.†

It is also a most remarkable, but still a certain fact, that vast herds of game, as a rule, are found only in regions possessed of a scanty vegetation, such as we have been here describing; and that the great game countries

* See *Five Years of a Hunter's Life in the Far Interior of South Africa* (1843 to 1848), by Roualeyn Gordon Cumming of Altyre, 2nd Edit. 1850, pp. 288 to 290.

† See among other evidence the *Journal of Colonel Warburton*, the Australian Explorer, pp. 156—7; also Stanford's *Compendium of Geography and Travel for Australia*, edited by Alfred R. Wallace, 1879, p. 21.

of the world are mostly dry, barren, inhospitable plains. It is in such localities that almost all the heavy game quadrupeds have their home. The popular idea, that large animals require luxuriant pasturage is, according to the high authority of Mr. Darwin, entirely fallacious. The reasons why these things should be so would involve the consideration of a host of technicalities, which will be discussed in their proper place, in our "sporting" sections. *

Almost the whole of this class of country, however, in the dry season, in consequence of the drought, assumes a peculiar yellowish brown tint, so far as the grass is concerned, which is reduced to the condition of a species of natural hay; whilst the twigs and bark of the withered, stunted bush are everywhere pervaded by an equally peculiar sombre shade of dusky dun, or ashen colour. In East Central Africa there are many thousands of square miles of this class of country: "of" (according to Professor Drummond) "vast thin forest, shadeless, trackless, voiceless—forest in mountain, and forest in plain—this" (he says) "is East Central Africa." † There are vast areas of similar land in South Africa also.

Hence we find that Nature has in many cases closely assimilated the colour of the hides of animals and the plumage of birds, to match the peculiar dull, dusky hue of the surrounding bush. The elephant, the rhinoceros, the Indian and African buffalo, the wild boar, etc., furnish good examples of this species

* See our chapters on Hunting and Stalking on Plains, and Forest and Jungle Shooting in vol. iii.

† *Tropical Africa*, by Professor Henry Drummond, 1888, p. 53. N.B.—This country almost all lies 3000 to 5000 feet above the sea level, which accounts for the absence of heavy forest.

of protective colouring. The colour of an elephant's skin, for instance, harmonizes so wonderfully with it, that though to the uninitiated the fact might appear almost incredible, those immense quadrupeds are often entirely invisible, even to an experienced eye, when standing motionless among the bush, close to the observer. This motionless attitude is a habit peculiar to nearly all game animals whose haunts are among trees; when listening to the approach of a suspected enemy, or an intruder upon their wild domains.

Then again, there is another, the "striped" form of animal colouring; this we find strongly marked in the Bengal tiger, the striped hyæna, the zebra, and the giraffe. Seen in a gallery of natural history, the skins of these animals would appear to be of so "loud" a pattern, that one would naturally suppose they would be instantly seen, at any reasonable distance. But in reality it is not so—instances have been known of travellers surrounded by herds of the two latter species of these creatures, who still thought themselves alone, amidst the silent desolation of the wilderness; and it was not until they moved that the deception became apparent, as the startled game bounded off and vanished into the bush.* The striped skins of these animals, so long as they remain perfectly motionless, appear in their natural haunts to have exactly the effect of rays of light cast by the sun through the intertwining twigs and branches of the surrounding covert. Further details with respect to these and other similar matters, which we trust may prove both interesting

* See for example an incident recorded by Professor Henry Drummond in his *Tropical Africa*, 1888, p. 167.

and instructive, will be found in the section on "Forest and Jungle Shooting."

This curious question of protective colouring is one which has long occupied the attention of naturalists, and other scientific observers, and numerous remarkable examples of it might be cited, especially with reference to our next section, The Desert Zone, and above all in connection with The Arctic Zone. The wonderful examples of Albinism or snow-coloured robing, that may be witnessed in the Polar regions, present probably the most perfect examples of Nature's marvellous power of adaptation in this respect: and to all those of our English readers who are in any wise interested in such questions, we would strongly recommend a visit to the entrance hall of the museum of Natural History at South Kensington, in London, where several glass cases are exhibited, showing quite a number of examples of the most striking forms of protective colouring, both of the *snow* (or Arctic) and of the *sand* (or desert) coloured types, among birds and the smaller quadrupeds.

As this is a matter which we purpose to refer to again in greater detail elsewhere, * we shall therefore pass on to consider certain points in the predominant colourings of landscapes, concerning which we should like to say a few words.

Most countries, if we think of it for a moment, will have graven themselves upon the tablets of our memory by some particular shade or tint which prevails throughout the colourings of their landscapes, in a way that is special to that particular country, and which we do not find prevailing in any other country; and we can

* See our section on "The Arctic Zone."

have no doubt that much of that love of country, which is so strongly marked a characteristic among all sections of the human family, and the existence of that national spirit of patriotism which preserves the autonomy of states, is largely due to an unconscious predilection for certain types of form and colour, prevalent in our native land, with which our earliest recollections have been associated. Thus the Scotchman longs for the purple tints of his heather-clad hills; the Swiss and the Norwegian for their pine-covered mountain slopes; even the Esquimaux loves his snowy wastes and the frozen glory of the arctic night. Many might suppose that the love of family, or of friends, is the chief attraction: but our colonials often take their families with them, or marry and form a family in the colony; in either case the family tie would thus seem to bind them closer to the colony than to the Fatherland, where after a lapse of years a man becomes forgotten, the friends of his youth being mostly scattered or dead. Yet, however long his absence, every British colonist longs, if he can, at least to revisit the land of his birth. It is the *country* therefore, which changes not, rather than the people, who do change, that is the true magnet that attracts. We have, moreover, been, on several occasions, profoundly struck by observing the affection felt towards the old country (the "Mother of Nations," as they call her) by colonials born and brought up in the colonies, who have arrived, it may be, at old age, before being able to visit the Mother land; yet we have seen such persons, when landing upon her shores, quite as visibly moved as any of those who as young men and women quitted the homes of their childhood in search of fortune.

Here then, clearly, the sentiment was that of attachment to the "old country," and not to family or friends, for they came as strangers to a strange land.

No one who has had any considerable acquaintance with our Colonial Empire can entertain much doubt on this head. The axiom "*Ubi bene, ibi patria*," is therefore only conditionally true; some races indeed may be said to carry this "home sickness" even to a fault, and never make good colonists in consequence. To avoid exciting European susceptibilities, however, let us select the Chinese, as a striking instance in point. No matter where John Chinaman may go, he is merely a migratory bird of passage; notwithstanding the grinding tyranny of his Mandarins, and however well off he may find himself abroad, he almost always looks forward to the day, when having acquired a sufficient fortune to maintain the level of his aspirations at home, he can carry back his savings to China.

His attachment to China does not even cease with his death, for it is part of his religious belief that wherever he may happen to die, his bones at least must go back for final interment in China. This fanatical longing for home, pushes almost to an absurdity the beautiful sentiment of the ancient classic: "*Coelum non animam, mutant, qui trans mare currunt*," * or again, as it has been as strikingly said, in somewhat different terms, by a celebrated French writer, "*C'est lorsque nous sommes éloignés de notre pays, que nous sentons l'instinct qui nous y attache.*" †

Returning, however, to the question of the local colourings of landscapes, it is curious to observe how

* Horace "*Epistolas*" i—ii—27.
† Chateaubriand.

even a very small change of climate and locality will affect them. Three causes seem mainly to govern the character of a landscape: (1) conditions of soil and aspect; (2) Elevation; (3) Latitude. But we shall merely touch upon the leading features of this question in the briefest possible manner. How different one plot of land may be to an adjoining one is well known; but it is not to these small differences that we desire to call attention, but to those great progressive changes produced by Nature over extensive areas. Each of the terrestrial zones, for instance, has its separate and characteristic colourings; most of them are even subdivided into subordinate zones, which differ materially from each other, and these variations in the predominant colour of the landscape seem to entail a more or less considerable corresponding change in the dresses of its fauna. In the equatorial forest zone for example, where the prevailing tint is a dark evergreen, many of the birds which inhabit the sun-lit tree-tops, are green, as in many of the parrot tribe; on the other hand the beasts which live beneath their gloomy shades, are mostly of a dusky brown, or tawny yellow, to match with the colours of the tree trunks, or of the jungle reeds. Then in the tropical and subtropical regions of the bush country, where the forest is more open, and the solar glare of greater intensity, because of the comparative absence of cloud, we meet with the striped form seen in the zebra, the giraffe, the tiger, etc.; and on coming to its drier regions, and to the actual desert, the sand colour gradually appears more and more, until in the desert proper, it prevails almost exclusively. Even among domestic animals these differences of colour, varying according to country,

are still maintained. In Europe, it might be supposed that this was the result of human interference: but this cannot be so to any marked degree, for it is not to colour that the breeder generally looks, but to entirely different qualities; yet these different types of colour still prevail.

For instance, though England and France are almost adjoining countries, the colours of French cattle differ in a marked degree from those of our English breeds; the appearance of the Swiss, or the Spanish cattle, differs again considerably from either, both in colour, and even in other physical peculiarities. In the London cattle markets therefore, where specimens of almost all the continental cattle are constantly seen, an experienced English dealer can tell at once, when he sees a beast before him, where it comes from.

We have, however, mentioned these variations in the types of domestic cattle merely because they exemplify in a high degree these local peculiarities which run through pretty well all the natural productions of the great terrestrial zones.

Now, the Bush Region is a country famous above all others for the great number and variety of its wild quadrupeds; many of which, in Africa more especially, are varieties peculiar to themselves, which do not occur elsewhere. The great size and weight of many of these animals also justly entitle them to take rank as the most magnificent specimens of wild game which the world contains. Some of the larger African antelopes, for instance, attain proportions almost approaching those of prize cattle, with which none of the antelope tribe elsewhere will at all bear comparison. Then as regards physical developments of shape, one

of the peculiarities noticeable among them, is the apparent disproportion in height between their fore and hind quarters. Some of these African game animals stand so much higher at the shoulder than they do behind, that their general appearance exhibits a striking peculiarity, entirely special to themselves. We may mention the giraffe (*Camelopardalis Giraffa*) and the hartebeest (*Alcelaphus Caama*), as leading examples of this type. In the case of the giraffe, however, it is probable that this exceeding peculiarity of bodily shape has in the course of ages been attained, on account of this animal being a tree-feeder, and constantly in the habit of reaching up to great heights, to browse upon the twigs and foliage of branches above its head. It is evident that its immensely long neck, and apparently disproportionately high fore-quarters, would thus become of great assistance in enabling the animal to obtain its food in this manner: which a full-grown giraffe could easily do at heights of at least twenty feet above the ground.*

The giraffe almost always frequents extensive tracts of dry bush forest, where ancient trees of nobler growth rise at intervals above the general level of the thorny scrub. All evidence goes to show that on account of the wonderful way in which the colours of their hides match the tints of the surrounding jungle, and the columnar appearance of their immensely long necks, which are easily mistaken for the trunks of dead trees, giraffes are often extremely difficult to catch sight of, when standing motionless among the bush; while their great height enables them to detect the approach of

* The measured heights for large male giraffes vary from eighteen to nineteen feet, when standing in their natural position.

enemies at a long distance off, as they can see right over a great many of the dwarf tree growths.

It would be easy to fill pages with technical details, as to the special peculiarities of the African game animals: such as the spiral horns, the curiously striped coats, or variegated colours of the various antelopes, which inhabit certain sections of the bush country; but these matters have been already described in many books of sport and travel.

The antelope tribe, of course, as a rule avoid the neighbourhood of heavy bush, and keep to the opener sections of the grassy plains. This instinct is common to all the varieties of antelopes. But the larger quadrupeds and animals of the deer tribe, on the contrary, cling to the thickets, to which they always retire during the heat of the day, or at least seek the shade of umbrageous trees which shelter them from the sun. The elephant and the buffalo, for instance, are sure to be found where trees grow most densely, and it is noticeable that those creatures have, as we have pointed out, dusky dun hides, which assimilate perfectly with the leafless bush: so that they too, when not in motion, are most difficult to catch sight of, on account of their protective colourings.

It is not, however, as game animals, or from a sporting point of view, that we desire just now to present these African mammalia to the notice of our readers.—Africa is a country full of wonders: all its productions seem marked by special peculiarities, distinct from anything of the kind met with elsewhere.

Why should this be? It is probably due to the fact that it is the most ancient of all existing continents. Distinct races and forms of life, therefore,

appear there, which no longer exist in any of the more recently formed territories. The fact of by far the greater portion of Africa being situated within the tropics, tends to render the survival of primeval races there more probable than if such were not the case; because the extinction of species seems more frequently to be brought about by *cold,* than by any other agency. Such, at all events, was the opinion of Professor Agassiz, the well-known naturalist, who seems to have been the first to recognize this probability *—a doctrine at present adopted by the majority of scientific men. Mr. Wallace, for instance, thinks that we can hardly fail to be right in attributing the wonderful changes in animal and vegetable life that have occurred in Europe and North America, to the intervention of two or more glacial epochs, which he believes led to "the extinction of a whole host of the higher animal forms" and extensive variations in the vegetation of these continents. † The fatal effects of cold upon the human race, and its effects in raising the bills of mortality at the present day, are well known, and we shall have more to say upon this head elsewhere in these pages.

From whatever causes, however, it may proceed, there seem to be good grounds for believing that the zone of territory representing "The Great Bush Region" upon the African continent is at this moment the home of the oldest of all surviving types of animal life: and, consequently, most probably of vegetable life also. The celebrated German traveller and learned naturalist

* See *Island Life*, by Alfred R. Wallace, 1880, Part i., Chapt. x, p. 222.

† See *Ibid.*, p. 119.

Emin Pasha,* in his Letters from Central Africa, thus expresses himself with respect to the fauna of that continent, which he says—"occupies a most exceptional position, as regards antiquity, geological antiquity I might say, compared with the existing types of later date; and indeed the camelopard, hippopotamus, Cape ant-eater, and others, belonging to a period of creation long passed away, intrude as anomalies in our times."† The hippopotamus, as we know, is at present exclusively confined to the warm waters of the great river systems of Africa; here it flourishes, but outside the tropics it is an exotic. Nevertheless—just to show what changes time has produced upon the face of our earth, both in climates and in the fauna of countries—there was a period when the elephant and the hippopotamus were common in Britain: entire skeletons of these animals having been found in a bed of dark blue clay at Leeds, while further North, at Kirkdale Cave, in Lat. 54° 15′ N., remains of the hippopotamus occur abundantly, along with those of the ox, elephant, horse, and other quadrupeds, including vast collections of remains of the hyænas which devoured them.§ This, of course, points with almost conclusive force to the fact that the climate of Yorkshire was *then* tropical in its temperature, while the great game of the African bush region disported themselves upon its wild primeval

* This was his Arab title. His real name and designation was Dr. Eduard Schnitzer. "Emin" in Turkish-Arabic means "The Faithful One." His intention was to practise as a Turkish physician, and by adopting this title "El Hakim, Emin Effendi" he hoped to avoid the prejudice felt against a Frankish practitioner.

† *Emin Pasha's Letters from Central Africa*, collected by Professor Schweinfurth and others; translated from the German by Mr. R. W. Filkin, 1888, p. 591.

§ See *Island Life*, by Alfred R. Wallace, 1880, p. 114.

surface. But even assuming that there may have been varieties of these animals which inhabited colder countries, all doubt as to the prevalence of a tropical climate in Great Britain, at an earlier era, is set at rest, by the finding of innumerable tropical ferns, palm leaves, and other remains of heat-loving plants, in the coal measures of the great Northern coal field. This makes good what we have said about vegetation being conclusive as to the climate of a country.

Reverting, however, to the question respecting the animals, stated on the high authority of Emin Pasha to have descended to our times as relicts from a vast antiquity—everywhere, as Mr. Wallace observes, the animals which have most recently become extinct, resemble more or less closely those now living in the same country.* Now, in the case of the giraffe or camelopard, we have an animal unique in type, all its congeners having passed away. The same may be said with reference to the hippopotamus. Neither resemble any other species of animals at present surviving in the African continent, or elsewhere.

These animals, in fact, are so entirely different from any of the quadrupeds at present existing in any other part of the world, that they represent to us, what undoubtedly seem to be the surviving types of a past age, when the earth was peopled with the extinct monsters of primeval times. Among these, numerous species of elephants and rhinoceri are known to have existed; of these the Mammoth *(Elephas Primogenius)* and the Mastodon (*Mastodon Var., Sp.*) were probably the most prominent representatives. They were im-

* See *Island Life*, by Alfred R. Wallace, 1880, p. 100.

mense beasts; the mastodon had long straight tusks, directed forwards instead of downwards as in the present elephants; and the mammoth enormous tusks which curled upwards. Large numbers of these animals, especially of the latter species, have been found embedded in the ice in arctic Siberia and other places, in a perfect state of preservation, the hair and skin which still existed unchanged showing that they were very much like the modern elephant in colour. *

The Encyclopædia Britannica gives a list of 22 species of mammoths, † and at least two kinds of Rhinoceri (*Rhinocerus Merekii*, and *R. Antiquitatis*) were found embedded in the ice near the Lena River, which according to Professor Nordenskiold, "may have lived hundreds of thousands, or even millions of years ago." § The probabilities are that the era when these creatures flourished, may certainly be measured by millions of years; as regards the Mastodon, for instance, the Encyclopædia Britannica says, "The range of the genus Mastodon, in time" (that is geological time) "was from the middle of the Miocene period to the end of the Pliocene, when they became extinct;" ** that would most assuredly relegate them back millions of years, beyond the commencement of historic time. When we speak of *geological time*, we must be understood to refer to ages whose remoteness must almost always be measured *in millions*, rather than in thousands of years. Even man himself, a modern

* See our Arctic section with reference to these and other extinct monsters.

† *Encycl. Brit.* Vol. xv., 9th edit., pp. 622-3.

§ *Voyage of the Vega*, by Professor A. E. Nordenskiold, translated by Alexander Leslie, 1881, pp. 411-12.

** *Encycl. Brit.*, Vol xv., 9th edit., p. 622.

evolution upon earth, when we speak of him as the fossil man of geological times, and are asked: How long ago did he live? though it must be admitted that nothing of a definite character is known about him, there is the reservation, however, to make, that when we put a date to the time of his advent upon earth, geological discoveries show that we must allow at least six figures to express it—but more probably seven: in other words, at least a million of years.

Now, as regards these stupendous periods of time, let us consider for one moment what they import: —

"One of the most important results" (says Sir William Fowler) "of the recent progress of science, and one which it is very desirable that we should have fully impressed upon us, is that the living world which we see around us bears an exceedingly small proportion to the whole series of animals and vegetables which have inhabited our planet in past ages."*

The discovery of vast numbers of fossil remains of different kinds of extinct forms of life, embedded in the stratified rocks of each of the great continents, may, we think, be very safely regarded as placing these facts so clearly in evidence, as to render them practically indisputable. They afford incontrovertible proof that the present races of animals and plants were not the original inhabitants of any part of the world where they now exist,—"but have appeared as descendants of a vast ancestry: the latest comers in a majestic procession," in which "we ourselves stand heirs of all the ages." †

* Opening paragraph of Preface to *The Creatures of Other Days*, by the Reverend H. W. Hutchinson, 1894, written by Sir W. H. Fowler, F.R.S., Director to the National History Museum.

† Quotation from the works of Sir Archibald Geikie (Geologist), printed as part of a motto appearing on reverse of his title page.

This question of the earth's antiquity is one which has agitated the minds of men from a very early period; and it is remarkable that, as the time rolls on, and as the results of fresh investigations are added to the sum of human knowledge, each additional series of facts collected, seems to oblige us to regard our earth as older—and yet still older.

"It is with time intervals measured by hundreds of millions of years" (says the late Mr. Proctor) "that we have to deal, in considering our earth's history"—"200 or 300 million years only carry us back to a period when the earth was in a state of development." *

When James Hutton, after many years of travel and research, made his first public announcement of what is now spoken of as "The Huttonian Theory," as to the earth's immense antiquity, in a communication to the Royal Society in 1795, his opinions were, almost as a matter of course, denounced as rank heresy, subversive of all religion; and as Lord Playfair has pointed out, although the announcement was one which *ought* to have attracted the notice of everybody, or of all scientific men at all events, yet such was the force of prejudice, that many years elapsed before it attracted any considerable amount of public notice or acceptance. There has been a great advance therefore in the education of mankind, when in these days we find the Huttonian theory accepted, in its principal features, as a matter of ascertained fact, by almost all persons possessing a fair education.

It would, however, be obviously out of place to encumber these pages with a series of technical details,

* *Our Place Among Infinities*, by Richard A. Proctor (Astronomer), p. 12.

with reference to the great subject of the earth's antiquity; these will be found fully discussed in all the leading works of authority on geology. In this chapter, however, we have spoken of the antiquity of certain great trees and we shall therefore add a few words as regards the antiquity of plant life.

Of course it goes without saying that plant life preceded animal life in point of time; seeing that animals for the most part live upon products of the vegetable kingdom, and those that do not live by preying upon those that do.

That being so, the tree-feeders and other herbivorous quadrupeds were probably evolved long subsequently to vegetation, in geological time: in other words, they first appeared upon the face of nature, it may be, millions of years afterwards.

And then again, there is reason to believe that a vast ancestry of the lower forms of organic beings, preceded by immense periods of time any of the more highly organized forms of animals such as we are familiar with. It seems also almost certain that members of the insect creation were among the earliest living creatures that came into existence; without their existence there is reason to believe that vegetable life must to a great extent have failed, inasmuch as it is by the visits of insects that many of their flowers are fertilized. This, however, is a subject that literally bristles with technicalities, which must be taken into consideration, in order to weigh the probabilities of what may or may not have taken place. It is also certain that among the enormous range of the insect creation there are many species whose eggs and larvæ would be peculiarly fitted to survive the

numerous difficulties which must have beset all the earliest forms of life, in earth's primeval days; some of these can survive exposure to salt water for considerable periods of time; others can exist in an undeveloped condition for indefinite periods and under every degree of heat and cold. All sorts of peculiar combinations of organization are to be found among the insect creation; for this among other reasons, it seems probable that these minute creatures are, some of them, perhaps among the oldest existing examples of living organisms. Still, the plant must have preceded the insect.

The vast variety which the range of plant life exhibits, must be evident to everybody. However poor the flora of a country may be, the number of its plants will foot up to a long list; while the interminable catalogues of the known varieties probably bear but a moderate proportion, compared with the whole number of plants in existence. Yet all these countless forms of vegetable life were themselves evolved, step by step, from an infinite series of ancestry, during enormous periods of time. How long, therefore, shall we suppose it has taken to originate one single new species of plant? All that can be said on this head is, that as a matter of fact it is exceedingly doubtful, whether within the whole range of historic time, *any instance whatever* can be given of a single new species which has been evolved, by the fertility of Nature, during that epoch, that is capable of perpetuating its own existence in the wild state.* Professor Sir A. Geikie, for in-

* It is desirable to note the fact that plants artificially improved, or apparently newly produced under culture, such as cereal grains, garden fruits, flowers, etc., are mere ephemera, incapable of perpetuating their

stance, states, as the result of his observations, that: "within human experience, a few species have become extinct; but there is no conclusive proof that a single new species has come into existence; nor are appreciable variations readily apparent, in forms that live in the wild state." *

As a matter of fact, for instance, the same flowers that formed the funeral garlands that were used to deck the Egyptian mummy of thousands of years ago, still bloom and flourish at the present day; † the same cereal grains and fruits, seeds and specimens of which were enclosed in their sarcophagi, still form the staple crops of the modern land of Egypt, practically unchanged by the accidents of time or culture.

Many ancient sculptures are also still in existence, adorning the walls of sepulchral chambers of vast antiquity—some of them executed quite six thousand years ago—which conclusively show that the trees, the plants, and flowers, and even the men and animals of those days—faithfully represented upon the chiselled stone—have undergone no visible change in Egypt during that immense period. These beautifully executed works of art moreover prove beyond question that though historic records may not yet have been discovered, going back further than that era, the civilization of Egypt was even then *an old* and highly cultivated civilization;

species in a wild state. Deprived of the fostering care of man, all these artificial varieties would quickly be overpowered and choked by weeds or other natural growths and become extinct. Some of these plants appear to be new species—they are however mere "sports" or accidental variations of the original stock.

* Extract from Presidential address of Sir Archibald Geikie to the British Association Meeting at Edinburgh, reported in *The Times* of August 4, 1892.

† In some of these cases, these flowers, in a dried state, still continued quite recognizable, when the coffins were opened.

for it goes without saying that these works of high artistic finish must have been the work of people already possessing an advanced, and therefore ancient, pre-eminence in the arts and sciences.

We shall have more to say presently about the antiquities of Egypt, in our following chapter; meanwhile in taking our leave of the Great Bush Region we shall merely observe that the whole of the evidence thus far collected respecting the earth's antiquity, tends more and more to establish the certainty of this great and salient fact, that the development of life upon our planet in its present highly organized condition, must have been the work of chronological periods, practically boundless in extent.

Eternity is not to be measured, either in its future or in its past, by any cycle of years, however numerous. Man therefore, in speculating upon his own ephemeral existence, and his position among infinities, may not unreasonably regard himself as poised upon a mighty centre, balanced midway between an infinite past, and an Eternity of ages yet to come.

CHAPTER VII.

THE DESERT ZONE.

Approximate Limits and Position of The Desert Zone. Erroneous Popular Ideas Respecting Deserts. Contours of Desert Territory in the Soudan. Limits of the Tropical Rains. The Nile Region. The Variable Rains of North Africa. The Algerian "Tell." Origin of the Word "Sahara." Arab Terms Denoting the Different Classes of Desert. Action of Sand under Influence of Wind. Movements of Sand Dunes. Buried Cities in the Desert of Gobi. Sand Storms. Whirlwinds, or Gyrating Storms. Alleged Destruction of the Army of Cambyses in One of These Storms. Account of the Catastrophe Given by Herodotus. Effect of Intense Drought upon the Dead Bodies of Camels, etc. Great Mortality of Animals on Caravan Routes. Losses of Men and Animals by Losing Their Way in Sand Storms. Causes of Sudden Storms in Deserts. Period of the Day when they are Most Prevalent. Description of a Desert Sand Storm. Precautions to be Taken. Sand-Drift as a Rock-carving Agent. Whirlwinds in the Nubian Desert. Pillars of Sand the Supposed Work of Evil Spirits. Arab Superstitions as to Genii, etc. The "Simoon" or Hot Wind. Injury Done by Hot Winds in Australia. Undulatory Motion of These Winds. "Red Fogs." Remarkable Instance of Red Fog at Sea. Some Scientific Aspects of "Dust." Formation and Collapse of Dust Pillars in the Mongolian Desert. Phenomena of Intense Heat. Hour of Maximum Temperature. "Goggles" or Sand Glasses. Effects of Heat and Drought in Arresting Decay. Mummies. The Egyptian Embalmers' Art. Egyptian Tombs. Great "Find" of Royal Mummies at Deir-El-Bahari. The preservation of Flowers, etc., in Mummy Cases. Immortality of Traditions of National Glory. Mirage—its Characteristic Effects. The Mirage and the Waters of Oblivion. Animals not Deceived by It. Loss of an Egyptian Regiment by Following Mirage. The Koran on Mirage. Effects of Vast Expanse upon Perspective. Effects of Atmosphere in Creating Illusions. The Desert Night. Rapid Fall of Temperature after Sunset. Necessity for Warm Clothing at Night. Cold Winds: their Causes and Penetrating Character. Night Marches—Question of Their Advisability. Count D'Escayrac de Lauture's Opinions. The Carriage of Water. Camels and Water. Camels and Green Food. Desert Watering-Places. Ancient Wells. Losses of Camels in traversing Waterless Tracts. The Oases. Water Courses. The Great Algerian Oasis of "Wargla." Beauty of the Oases. Their Generally Unhealthy Climate. Artesian Weils. Flora of the Desert Zone. The Date Palm,

Its Geographical Limits. The Koran on Vegetation and the Sequence of the Seasons. Cinnamon Growing in Pure Sand. The Scriptures on Vegetation and Human Life. Desert Plants. Thorny Acaciæ. Desert Grasses. Prickly Grasses. Valuable Character of Certain Desert Grasses. Dry Herbage, broken up and blown away by the Wind. The Scriptural Simile of Human Life likened to the Grass of the Field. Scriptural Description of Drought. Explanation of some of these Scriptural Allusions. Desert Animals. Protective Colourings of Gazelles. Beauty and Symmetry of the Gazelle. "The Gazelle Eye." Desert Birds. Ostriches. The Desert Nomads. Bedouin Ode to the Wilderness. Anecdote of Arab Self-Command. The Stranger, as "the Guest of Allah." "The Temptation of Sidi Aomar"—an Arab Legend. Ziaras, or Pious Visits to Tombs. Quarrels Settled by Appeals to Superstitious Fears. Arab Justice and Generosity. Execution of an Arab Murderess. Desert Scenery. Magnificent Effects of Desert Sunsets. Dr. Junker's Description of a Desert Journey. Fascinations of Desert Travelling. Count D'Escayrac de Lauture on Comfort during a Desert Journey. Mr. Gordon Cumming and Dr. Schweinfurth on Scented Desert Herbage. Pierre Loti on the Powerfully Aromatic Herbage of the Desert of Sinai. Tamarisk Manna. The Desert Thymaceæ. "The Smell of the Fields on the Garments of Jacob."

THE Desert Zone forms our third territorial division, counting from the Equator.

As in the former cases, one of these zones is placed in each hemisphere, upon the polar margin of the Bush Country—we must, however, at once admit, that though these deserts are to be found, more or less exactly occupying their positions in each of the great continents, right round the world, still their dimensions, owing to local causes, are enormously magnified at certain points, as for instance in North East Africa and Arabia; and their boundaries are much less regular, and less clearly defined, than those of the regions already described.

When therefore we venture to assign to the Desert Zones, a position extending from 25^0 to 30^0, of North and South latitude, occuping two bands, extending round the earth's terrestrial surface, each 300 geographical miles in width, we are aware that this can be regarded as only approximately correct. In the first

place the actual boundaries of these permanently desert regions are very imperfectly ascertained; the location assigned to them upon the map must consequently, in the same way, be regarded only as marking their approximate, and not their true position: indeed, from what has been already stated, in describing the dry regions of the Bush Country, it will be evident that it must be a question of considerable difficulty to decide at what point the dry bush country is supposed to end and the desert proper to begin; because at certain seasons immense tracts of the bush country become for the time being veritable deserts: that is, if we take the word "Desert" to mean an uninhabitable region, where man dare not tarry, except at a few widely scattered watering places, after leaving which the wayfarer must hurry on or perish.

If on the other hand we take it to mean a tract of country *always* destitute of vegetation of any kind, then there would be very few places which would deserve the designation of "Desert"; because almost everywhere throughout the desert zones there is more or less herbage, and occasional clumps of dwarf bushes.

The popular idea of the desert, as a perfectly flat surface of burning sand, without a particle of vegetation anywhere to be seen, must therefore be regarded as erroneous—the surface of the desert being in fact, as a rule, broken, irregular, and varied, like that of almost every other extensive territory, in nearly every kind of way. Some of it consists of mountains or precipitous hills, the rest mostly of undulating ground; very little being really level.

For instance, in the survey made by order of the Egyptian Government in 1876, for the proposed line

of railway to the Soudan, "out of about 800 miles" which were levelled "only one single stretch of eight or nine miles" was found to be "really plain and almost level," * all the rest is described as rolling ground, with isolated hills of various sizes showing upon the horizon, while from Abu Gusi south east to Khartoum, a distance of some 200 miles, the country partakes almost of a mountainous character—the caravan route which of course selected the lowest ridges, climbing "up and down slopes of 100 and 150 yards in height." † It is therefore clear from the account given by the railway engineers, that the great desert region through which the Soudan railway would have had to pass, has a surface quite as varied as that of most plain countries.

Then as regards the supposed entire sterility of the desert, we are assured by the same authority that during the many months that the different parties of surveyors spent in exploring the country, they "never fed one camel in the desert, and not one died of hunger." § All this shows how erroneous are the popular notions of what "a desert" is.

The essential characteristic of the true desert is that of a country possessed of a rainless, or nearly rainless, climate—where drought may be said to be almost continuous; for in the desert proper there is no regular rainy season; any rains that do fall are intermittent, and altogether uncertain in their character. Some years, rains—even torrential rains**—may fall for a few

* *Desert Life*, by B. Solymos (Railway Engineer) 1880, p. 35.
† *Ibid.*, p. 35. § *Ibid.*, p. 59.
** This was well illustrated in the first days of August 1896, while these pages were in the press, by a British camp being nearly swept away by a sudden flood in the Nubian Desert, during the Soudan Campaign then in preparation.

days, as the existence of considerable numbers of dry water courses, dry saline lake beds, and the marks of ancient torrents, conclusively proves; whilst during other years the rains may be practically nil—indeed, in most of the principal deserts, according to the reports of residents inhabiting the various oases, it is stated that sometimes for several years in succession, not a drop of rain has been known to fall. Thus in the oasis of "Tuat" in Southern Morocco it is said "to rain scarcely once in twenty years." * Some of the Arabs inhabiting this region have even been known to doubt the fact of its being *possible* for water to fall from the sky.

The phenomenon of the tropical rains has already been discussed in considerable detail; the incessant rains of the equatorial zone being shown to become changed, first, into zones of double rainy seasons; and next, into those where a single rainy season prevails; this latter gradually getting shorter and shorter, until at length there is no longer any regular rainfall; the rains become more and more intermittent, and we enter the almost rainless desert zone.

Endeavours have from time to time been made by various observers to try and fix the exact points where these changes may be said to take place; but they are so gradual in their nature, and so liable to be modified by local circumstances, that the attempt has been attended with only very partial success, for these countries are visited by comparatively few travellers, and they generally endeavour to time their journeys so as to pass through at a period when native reports show that the wells are fairly well supplied; the caravan

* *Stanford's Compendium of Geography and Travel for Africa*, 2nd Edition of 1880. Edited by Keith Johnston, p. 26.

routes in some of the more waterless tracts having to be entirely closed for traffic at some seasons:—thus the Egyptian Government at one time closed the ancient caravan road across the Nubian Desert, from Korosko to Abou Hammed, on account of the dreadful mortality which took place upon it, but it was reopened upon the application of foreign consuls, as the most direct route to the Soudan.*

In Northern Africa the Desert Zone may be held to attain its greatest proportions, and the French traveller Count D'Escayrac de Lauture, who had extensive experience of desert travelling in the Sahara, and in the region to the southwards known as the Soudan, thinks that the regular tropical rains do not reach higher than to about Lat. 17° N.,† while a later authority, Mr. Keith Johnston, in the last issue of his Royal Atlas, fixes the limit of these rains, at the parallel of Lat. 18° N.§ An examination of the map will show that this line passes as nearly as possible through the important town of Berber, on the Nile, and slightly to the southwards of the western limit of the great bend of that river, near Korti, now celebrated as having been the British store depot and point of departure for the force which marched across the Bayuda Desert, for the relief of General Gordon, at Khartoum, in 1885. The objects of that expedition, as we may all remember, were frustrated, not through any fault committed by the distinguished general who commanded it, but through the fatal influence of civil politicians at home, who

* See *The Nile Tributaries of Abyssinia*, by Sir Samuel Baker, 1867, p. 15.

† *Le Désert et Le Soudan*, Études sur L'Afrique au Nord de l'Equateur, par M. Le Comte D'Escayrac de Lauture, Paris 1853, p. 60.

§ See Keith Johnston's *Royal Atlas*, published 1884, Map No. 42. (Egypt and Nubia.)

could not be induced to make up their minds, until too late in the season, when the waters of the Nile which formed the British line of communication, were known to be rapidly falling. The expedition was therefore foredoomed to failure by starting at the wrong time of year; the numerous accounts of it that have been published, however, show that there was generally a good supply of coarse grasses for camels throughout the whole extent of this desert march, of 185 miles, measured in a direct line from Korti to Gubat, but that except in small quantities permanent water of good quality was then to be found at one place only, known as the fountain of Gakdul, situated about midway between these two points.

The Nile region, from the remotest ages, has been the constant wonder of the world—all the phenomena of its existence appearing unprecedented, mysterious, and inexplicable—for here the desert assumes its most gigantic proportions; and the great river itself has steadily flowed from age to age, for nearly 1200 miles, through an almost continuous desert, without being fed by a single affluent. For a great part of its course the river has worn its way through an almost rainless region: so dry are the adjoining deserts, and so scanty and uncertain are the rains, that the cultivation of crops of any kind is totally impossible without constant irrigation by means of canals and waterwheels. For the greater part of the way from the first to the second cataract, for example, the actual width of Egypt is only a few yards bordering the edges of the Nile—the rest is sand.

These vast and interminable deserts, called by whatever name we please, the Nubian, the Libyan, or the Sahara, form to all intents and purposes one continuous

stretch of desert country, extending across northern Africa from the Red Sea to the western ocean. Up to the present, the southern limits of this great region have been only very imperfectly ascertained; but still enough is known to show that the enormous area of desert which occupies the north eastern corner of Africa gradually becomes narrower as we proceed towards the westward, the southern limits of the actual desert trending more and more towards the northward, until in North-West Africa, the limits which we have ventured to assign as the normal extent of this zone are not greatly if at all exceeded.

Upon its northern boundary the Sahara merges into a region visited by variable rains, which come down from the Mediterranean during the winter season—but observations made by the French show that even in Algeria these rains rarely extend further from the coast than a distance of about 100 leagues, or say a little more than 240 English miles, * as the greater part of the rainfall is intercepted by the chain of the Atlas Mountains which extends across Northern Africa as far as the Gulf of Gabes.

The region to the north of these mountains in Algeria is known as the "Tell," from the Latin "Tellus," which mostly consists of pasture and cultivated lands—in Morocco this territory is known as the "Riff," but as can be seen from the signal station at Gibraltar, where a magnificent panorama is visible, the mountains extend much nearer to the coast than in Algeria, some of the foot hills of the high ranges in fact coming down to the coast line.

* *Le Dèsert et Le Soudan*, Études sur L'Afrique au Nord de L'Equateur, par M. Le Comte D'Escayrac de Lauture, Paris 1853, p. 2.

The Algerian Tell begins on the Mediterranean, and extends to the foot of the Middle Atlas, of French geographers, "with an area computed at about 54,000 square miles and an average breadth of not more than 47 miles."* It becomes wider, however, towards the west. Behind and south of the Tell is the "Région des Plateaux," sometimes called the middle range of the Tell, a region consisting of mountainous table lands, rising to a height of 3800 feet above sea-level, interspersed with a series of brackish lakes, or salt marshes, called "Shotts." Most of this country is pasture land, corn being only grown in favoured spots, —and the land is generally covered with dwarf aromatic herbs and high grasses, supplying good fodder for cattle; but after the wet season is over difficulties arise about water, the stagnant pools, etc., being named "Ghedir" (traitor) by the Arabs, on account of their uncertain nature, as no dependence can be placed upon their supply, and most of them dry up entirely.

These table lands are bounded on the South by the "Chaine Saharienne" or "Great Atlas" of the French geographers, which form "a series of detached elevations some forty or forty-five miles broad, rising here and there to considerable heights, which are usually covered with snow till the end of March"† and we have seen snow there at the end of April the winds at this season being also intensely cold and penetrating. From these mountains numerous streams flow down to the southwards into the Sahara, which gradually become lost in the sand, or terminate in salt lakes. But the same difficulty in ascertaining the exact limits of the desert

* Stanford's *Compendium of Geography and Travel for Africa*, 2nd Edition, 1880, edited by Keith Johnston, pp. 18 and 19.

† *Ibid.*, p. 21.

meets us here as elsewhere. According to the French General Daumas whose map of the Sahara Algérien, engraved under the direction of the French War Office, has always been considered a leading authority on these matters,

"The desert comes up, in the region placed to the south of Oran and Tlemsen, between the 32nd and 29th parallels of latitude, under the name of 'Djebel Batten'. The line of the watershed follows this direction and there presents two great inclines, one towards the Sea, and the other towards the interior of the Sahara" *—but the General goes on to explain that "from the 29th parallel of latitude we are in the desert technically called '*El Falat*'. Life seems to cease until the 27th, where it reappears for a moment in the mountains of Touareg, and then disappears entirely, as far as the Soudan or the country of the Negroes." †

Here it may be well to explain that the word "Sahara" does not by any means necessarily imply an uninhabitable desert, but rather a vast low-lying plain of sand or grass—and large tracts upon its northern frontier consist, at certain seasons, of well watered pasture lands, as the number of "*wadis*," or streams, marked upon the map, conclusively shows, but after the cessation of the rains, these waters quickly dry up; thus compelling the abandonment of the greater part of these plains; the Arabs being then obliged either to migrate into the hills, or to retire into the numerous oases, where permanent fountains exist.

Not to be too prolix and technical upon a matter which has given rise to a great deal of controversy even among the *tolba*, or literary Arabs, themselves—

* *Le Sahara Algérien*, Études sur la région au Sud des Etablissements Français en Algérie, par le Lieut.-Col. Daumas, published 1845, p. 4.
† *Ibid.*, p. 5.

the word "Sahara" seems rather to mean, the "land of the *Sehaur*" (otherwise "Sahar") or sunrise, perhaps because the sun seems to rise out of the plain, as it seems to do out of the water at sea. The "Sehaur" indicating the brief moment dividing the night from the day, that immediately precedes the "Fedjer" or dawn.—The Sehaur is the last moment during which it is still lawful to eat, drink, and smoke during the month of Ramadan or sacred fast; while the "*Fedjer*" or first dawn indicates the moment when a white woollen thread can be just distinguished from a black thread, from which time until sunset (*El Moghreb*) the most rigorous abstinence is imposed upon the faithful. According to Mohammedan ecclesiastical law every true Moslem is supposed to be up and ready at El Fedjer, this being the hour of Morning Prayer. It is regarded by strict Moslems as a great sin to be still slumbering when the sun arises.

Then as regards "the desert," there are three words in general use among the Arabs of the Sahara, to denote the various kinds of country most usually met with. "*Fiafi*" indicates the habitable desert, such as the oases where permanent water fountains exist—"*Kifar*" or "*Khela*," "the abandoned country," comprising the wide and sandy plain, mostly consisting of pasture land during and for some time after the rains, but which want of water causes to be subsequently abandoned"—lastly "*El falat*" is the uninhabitable sea of sand, sterile and bare, whose eternal waves, raised by the scorching breath of the simoom into billows of drifting sand, not unfrequently bear a strong resemblance to those of a stormy sea, suddenly turned to stone. *

* See *Le Sahara Algérien*, par le General Daumas, 1845, p. 3.

There are also other terms to designate the rocky *(warr)* or bushy *(ghaba)* districts, while "*Ghoud*" is the region of sand dunes.*

These drifting sands constitute quite a history in themselves. They testify in the first place to the prevalence of strong gales of wind blowing from the same quarter, whose force has been sufficient to raise up these great systems of sand dunes from fifty to sixty, and sometimes one hundred feet in height, and more. Wherever the sand is deep these dunes are likely to be formed, and where it is shallow, as upon the wide expanse of flat plains where the wind passes over the surface without being able to get much hold of the sand, there are simply *ripples*, such as are seen on the sea shore when the tide is low; but generally here and there through these plains regular undulations may be observed, evidently formed by the heavier drifts which almost exactly represent the rollers which follow each other in rhythmical sequence across the ocean after the subsidence of a severe storm.

Sand in fact, notwithstanding its great specific gravity, acts in many respects very much like water, under the influence of the winds; and where it meets with an obstacle, it mounts up in spray, exactly like broken water hurled by the violence of the waves upon a rock-bound coast; but of course its non-fluid character prevents any reflux, as in the case of water, and so these dunes are gradually heaped up and are always kept moving on. The forward movement of the sand waves proceeds under a regular system, which has been described by Count D'Escayrac de Lauture with great minuteness.

* *Le Dèsert et Le Soudan*, par M. Le Comte D'Escayrac de Lauture, 1853, p. 18.

The undulations, of whatever size, generally show a gradual slope *towards* the wind; while the driven sand keeps constantly pushing upwards; and then flowing over the crest it falls down *away from* the wind on the opposite side in a much steeper slope. From a number of measurements taken with a clinometer in the deserts of Sinai and Egypt the angle of rest for dry running sand has been ascertained to be 31 degrees.* Careful observations of drifting sands, when carried out during a series of years, seem to show that it is never at rest; and that the whole mass is, in many places, kept slowly moving forward under the influence of the prevailing winds. The sand dunes upon the West Coasts of Ireland and France furnish good examples of this, and French observations seem to show that the forward movement of the sand dunes on the French coasts amounts to about twenty to twenty-five metres per annum.† This rate of progress must, however, we think, be somewhat exceptional; because if no steps were taken to prevent it the sand would advance something like a quarter of a mile in twenty years. Nevertheless that sand dunes do advance with greater or less speed, is a well ascertained fact; and great injury has sometimes been done by them; houses, lands, and even cities, being engulfed, and buried beneath the drifting sand.

In the desert of Gobi for instance the remains of several ancient towns or cities have been discovered, which were buried in the drifting sands at periods of unknown antiquity; and in one or two cases these

* See *The Engineer* of June 14, 1889.

† M. Le Comte D'Escayrac de Lauture, *Le Désert et Le Soudan*, 1853, footnote to p. 34.

buried cities are now in process of disinterment—that is to say, the sand, while still moving on from age to age, seems to have passed by the sites of these ruins, leaving them now exposed to view. "The walls though only built of sun-dried brick, still stand, and exhibit the holes in which the rafters were inserted, as clearly as if they had only been just used," and though it may seem strange that such structures should be preserved through so many ages, this is readily accounted for by the extreme dryness of the climate.* We shall have more to say, however, upon the marvellously conservative action of these climates further on. Meanwhile, reverting to the question of the sand drift, if we examine the storm-blown surfaces of any great desert or other sand plain, it will be seen that even a small stone, or tuft of grass, by creating an *obstacle*, will form its own miniature dune, and the sand will be observed to form a rounded heap against it, to windward, and then passing round the sides, to settle, and form a species of triangle, to leeward; thus marking the cone of the sheltering influence of each obstacle: almost exactly as is done by a rock protruding above the surface in a swiftly flowing stream of water, the cone of shelter influence, being in the latter case marked below the rock, by a calm area, and backwater.

All deserts seem to be peculiarly liable to sudden storms of wind, some of which are of extraordinary violence, and carry sand, and even small pebbles along with them in a wonderful way; the air being sometimes so thickly filled with fine particles that it becomes

* See paper on the Shifting Sands of the Great Desert of Gobi and the Buried Cities, by Sir T. Douglas Forsyth, K.C.S.I., in Journal of R.G.S. Society, Vol. xlvii., 1877.

painful and possibly even dangerous to respire it—the dust on these occasions being of so fine and penetrating a nature, that it makes its way *everywhere*, and through every sort of covering, no matter what precautions may have been taken to exclude it—and is of course very prejudicial to the works of watches, and other delicate instruments, including breech actions, and locks of guns, etc. * Watches therefore should be wrapped up in wash-leather bags.

In some of the great deserts, these storms frequently take the form of whirlwinds, and columns of sand and dust appear gyrating across the plain in a most threatening way, apparently menacing passing caravans with destruction. Many stories are related by the Arab historians of instances in which whole caravans, and even armies, have been suddenly overwhelmed by these storms, and buried in the sand.

In these incredulous days, however, these histories have come to be regarded as exaggerations, and there can be no doubt that this modern view of the case is substantially correct—these calamities, when they have occurred, being probably due to thirst, and not to sand storms, although the partially buried corpses, subsequently found more or less covered by the sand drift, may at first sight appear to furnish strong corroborative evidence of their destruction by a whirlwind.

The destruction of the army of the Persian Monarch Cambyses (B.C. 524) † which perished in the Libyan

* In the dry plains of South Africa where cold winds and dust storms are prevalent, experience shows, that "pneumonia" or acute inflammation of the lungs is a thing always to be dreaded. At Johannesburg and other places in the Transvaal in winter it is sometimes exceedingly fatal, acute cases proceeding to a fatal issue in the course of a few hours.

† *The History of the World*, by Philip Smith, Vol. i., p. 286.

Desert, furnishes us with a suitable instance in point. This army consisted of 50,000 men sent to destroy the Temple of Jupiter Ammon, and all perished in the burning sands. * Count D'Escayrac de Lauture, an acute and accurate observer of desert phenomena, however, has come to the conclusion that this memorable event, so often referred to in discussions upon this subject, is in all probability due, either to the men having simply lost their way in the desert, or perhaps having been betrayed by unfaithful guides, and so having fallen victims to the slow tortures of thirst; † and this seems the more probable, Cambyses having, according to Herodotus, incurred the hatred of the Egyptians, in consequence of the frightful atrocities to which he had subjected Egypt during the previous year. The account given by Herodotus of the loss of the Persian army is as follows: "When the army reached Thebes, he (Cambyses) detached about 50,000 men, and ordered them to reduce the Ammonians to slavery, and to burn the oracular temple of Jupiter while he with the rest of his army marched against the Ethiopians." § Herodotus then proceeds to detail the losses sustained by the latter force in consequence of failure of provisions, and the subsequent retreat of Cambyses to Thebes "after losing a great part of his army" and proceeds to narrate that

"Those who had been sent on the expedition against the Ammonians, after having set out from Thebes, marched under the conduct of guides, and are known to have reached the

* Haydn's *Dictionary of Dates*, 14th Edition (Article "Egypt").

† *Le Désert et Le Soudan*, par M. Le Comte D'Escayrac de Lauture, 1853 p. 42.

§ Herodotus, Book III (Thalia) Ch. 25. Literally translated from the text of Baehr by Henry Cary, M.A., 1891, pp. 151—2.

City Oasis which is inhabited by the Samians, said to be of the Œschrionian tribe,—and they are distant seven days march from Thebes, across the sands. This country in the Greek language is called the Island of the Blessed. It is said then, that the army reached this country; but afterwards none except the Ammonians, and those who have heard their report, are able to give any account of them; for they neither reached the Ammonians, nor returned back. But the Ammonians make the following report: when they had advanced from this oasis, towards them, across the sands, and were about half way between them and the oasis, as they were taking dinner, a strong and vehement south wind blew, and carrying with it heaps of sand, covered them over; and in this manner they disappeared. The Ammonians say that such was the fate of this army." *

Now, if, as Count D'Escayrac de Lauture supposes, the army once lost their way, they would have very little chance of finding it again, for as he points out, their trail would be immediately effaced by the freshly drifted sand, so that it would have been impossible for them to retrace their steps; thus it seems more than probable that the only memorial of this great catastrophe may have been the subsequent discovery of their bones, or of the desiccated corpses, converted into a species of leather by the combined action of the sun and the extreme drought. It is a well-ascertained fact that the conversion of animal remains into their primary elements of "dust to dust" according to the popular formula—is due to a species of fermentation which, under natural conditions, will, in the case of the human subject, accomplish this salutary and beneficent work of nature, in about a year or eighteen months, that is provided that the process of Nature is not interfered with.

* Herodotus, Book III (Thalia) ch. 26, translated by Henry Cary, M.A., 1891, p. 152.

In the desert, however, the exceedingly rapid evaporation, and the almost total absence of moisture in the atmosphere, has the effect of arresting decomposition —and thus it comes to pass that the bodies of camels, etc., which have fallen by the wayside, along the caravan routes, are often found to retain their original appearance for a great length of time—the remains not uncommonly, where there are no beasts of prey to devour them, presenting the appearance of the animals stretched upon the ground, and taking their natural repose, almost exactly as in life.

In the description given by Sir Samuel Baker of his march across the Nubian Desert, there is a striking picture of the scene presented at a desert watering place known as El Moorāhd, or "The Bitter Well," on the caravan route between Korosko and Abu Hammed.

"The valley" (he tells us) "was a 'valley of dry bones'. Innumerable skeletons of camels lay in all directions: the ships of the desert thus stranded on their voyage. Withered heaps of parched skin and bone, lay here and there, in the distinct forms in which the camels had breathed their last; the dry desert air had converted the hide into a coffin. There were no flies here, thus there were no worms to devour the carcases, but the usual sextons were the crows, although sometimes too few to perform their office." *

Throughout this desert march of 230 miles, waterless except at the point already indicated, the route is in many places actually marked out by the bodies of these poor, patient, and enduring creatures, for throughout the route from Korosko, Sir Samuel Baker states, "the skeletons of camels number about eight per mile," and for part of the way twice that number, while in

* *The Nile Tributaries of Abyssinia*, by Sir Samuel Baker, 1867, p. 10.

a steep pass through a range of hills, where the heat is intense and the sand deep, the route is a mass of bones, every weak animal giving in at this trying place. * We give these details, we need hardly say, in illustration of the difficulties and dangers of desert marches.

Thirst and fatigue, however, in all these cases have been the cause of this frightful mortality, and so far as we have been able to discover there is no recorded instance, where the losses have been known to occur from men or animals being overwhelmed by a sand storm. In the surveying expedition for the Soudan railway some of the tents were occasionally upset by moving pillars of sand, but that was all. † Men have, however, constantly been known to get separated from their companions, and lost during the profound darkness which is occasioned by the dense clouds of dust which these storms create, and, if they lose their presence of mind, may wander away, in their hopeless endeavours to rejoin their companions, so that it may become difficult, or even impossible, to find them again: the noise of the tempest effectually preventing shouts, etc. being audible. General Daumas records one such case, where the man, an Arab, was lost in the midst of an immense waterless sand plain; he was unfortunately not missed until the evening halt, and was of course unable to pick up the trail of his caravan, which was effaced as soon as made; and though the caravan halted the whole of the following day, and parties of mounted Arabs started in different directions in hopes of finding him, he was never heard of again; the caravan being of

* *The Nile Tributaries of Abyssinia*, by Sir Samuel Baker, 1867, pp. 14, 15.

† *Desert Life*, by B. Solymos, 1880, p. 16.

course subsequently forced to continue its march, as their water supply had run short. *

The occurrence of these furious squalls and tempests is, however, only a natural consequence of the sudden and extreme alternations of heat and cold, to which all very dry regions are subject. When we remember that the winds themselves are caused by changes of temperature, it must be evident that these phenomena of sudden storms are only what might be expected to occur everywhere throughout the desert zone. These questions have, however, been fully commented upon in the Section on "Climates and Temperatures," to which we beg to refer the reader.

The period of the day when the solar heat is at its maximum, it may be desirable to repeat, is generally in the afternoon, say about three p.m., and consequently these storms are much more common in the afternoons than in the mornings, though of course they may occasionally occur at any hour, especially during the prevalence of the simoom or hot wind.

Such storms usually, however, come up shortly before sunset,† because it is at that hour that the changes of temperature begin to be very marked, but the wind does not in general attain its greatest intensity until after the night has fallen, § because it is not till then that the fall in the temperature has become considerable—the reduction in the temperature after nightfall being generally very rapid. Count D'Escayrac de

* See *Le Grand Désert, Itinéraire d'une Caravane du Sahara au Pays des Nègres*, par Eugène Daumas (French General), Paris 1848, pp. 299—301.

† *Le Désert et Le Soudan*, par M. Le Comte D'Escayrac de Lauture, 1853, p. 38.

§ *Ibid.*, p. 36.

Lauture, an authority of considerable weight in these matters, has recorded these facts, while we have ventured to assign the reasons for them which we make bold to think are borne out by scientific data.

One of the remarkable features connected with these storms is the extreme suddenness with which they sometimes come on. The following account of one of them is abridged and translated from the description given by Count D'Escayrac de Lauture—

"Travelling during a lovely night in the month of June, in the desert, about three days' journey from Suakim, I was enjoying the striking clearness of the heavens, where no cloud obscured a single star. I was admiring the profound calm of the atmosphere, when all of a sudden the scene changed; a black cloud showed itself in the East, rising with frightful rapidity, and in a few moments covered one half of the sky. A sudden squall, of extreme violence, covered us with sand; and pebbles, the size of peas, beat upon our faces. Soon the whole heavens were covered with an immense cloud of sand, enveloping us in profound obscurity, which made it impossible for us to find our way. We had carefully wrapped up our faces, but we could not open our eyes without getting them filled with sand. The camels groaned and knelt at almost every step. I succeeded with difficulty in getting my men together, whom the obscurity, and the restiveness of their camels, had separated; and although the most distant was but a few paces away they ran the greatest risk of getting lost, my voice, which I exerted with all my strength, being hardly audible. We stopped, and the camels at once stretched themselves out upon the sand, while the men were so harrassed by the hail which pelted upon them, filling their eyes, noses, and mouths with sand, that I did not attempt to have the animals unloaded. Sheltering myself against my hygeen, whose high saddle afforded some slight protection, I enveloped my head with a long Tripoli shawl, which formed

my girdle, and though not daring to dismiss from my mind the fear of being buried beneath the deluge of sand, still finally I dropped off to sleep, and my men imitated my example.

"When I awoke at daybreak, the great calm had returned, the heaven had regained its clearness, and casting my eyes around me I saw the camels covered up to their necks in sand; one of my camel drivers, who still slept, had three inches of sand upon his chest, and I could no longer find my sword which I had placed beside me, and which it took me some time to find again." *

The difficulties of caravans are often increased on these occasions by stampedes among their camels, which becoming frightened by the fury of the gusts, and rendered frantic by the ceaseless hail of sand and gravel beating upon them, are apt to break away, and get lost in the darkness and confusion. These animals have of course to be hunted up if possible the moment the storm has abated, and the light returns. But as the possibilities as to delays are limited according to the quantity of water in possession of the party, and their distance from the next watering place, considerable losses are not uncommon; for this reason among others, according to Count D'Escayrac de Lauture, it is always desirable to push on and continue the march as long as it is possible to guide the caravan in the right direction, the party keeping together as closely as possible, so as not to become separated from each other, because all traces of the trail, are, of course, instantly obliterated by the drifting sand. † The camels, however, are always very unwilling to face the wind

* *Le Dêsert et Le Soudan*, par M. Le Comte D'Escayrac de Lauture, Paris, 1853, pp. 39—40.

† *Ibid.*, pp. 48—9.

and the eddying clouds of sand and dust; there is therefore great difficulty in the matter, and so caravans generally halt during severe storms, unless questions as to water supply are very pressing.

The force with which the sand, and even small pebbles, are driven by the violence of the wind, on these occasions, is at times quite phenomenal. To face it at all, a man requires to have his eyes protected with closely fitting sand goggles, and the rest of the face, below the eyes, had better be protected by a handkerchief, used as a veil—a plan which we have successfully adopted in a very bad storm. In torrents, it is well known, the force of the current will in course of time wear away the hardest rocks, and mould them into all kinds of curious shapes. The sand drift has very much the same effect as swiftly running water, in this respect, and where it impinges against a mass of rock, by its constant attrition, will carve it into fantastic shapes, very much resembling the action of water, cutting its surfaces into cup-like cavities, of considerable size and depth, like the "pot-holes" in the beds of mountain torrents. In a recently published work, describing a journey in the desert between the Nile and the Red Sea, a photogravure is given of rocks sand-worn in this manner.

"Another moulding agent," (says the writer of this book) "of little power in northern climates, is here (in the Egyptian desert) a potent instrument in producing unfamiliar effects in rock carving. I refer to the sand, driven before the wind, which honeycombs and undermines the hardest rocks." *

Many of the curiously eaten away, abraded surfaces

* *On Either Side of the Red Sea*, by E. N. Buxton, 1895, p. 5 of introduction—part 1, "The Nile and the Eastern Desert."

of rocks in these deserts, which have sometimes puzzled visitors to account for their appearance, are no doubt caused by sand-drift, which is here a very powerful wearing-away agent. Thus, the undermining of cliffs and other masses of rock may be effected by the constant drift of sand driven in one particular direction by the prevailing winds, and the remarkable circular cavities made in positions where it would have been impossible for water to get at them, is probably caused by revolving storms, which causes the sand drift to revolve, and grind their interiors with great velocity and force. All along the Nile these sand-carvings are common.

What are known as whirlwinds are merely another variety of these storms, where the effect is sometimes merely local, and the wind gyrates in spiral form, with more or less velocity. These curious phenomena seem to be most common in the great deserts of Egypt and Nubia, and the month of June appears to be the period during which they are most prevalent. Sir Samuel Baker, another leading authority in these matters, states that their force is often "sufficient to raise dense columns of sand and dust, several thousand feet high," which frequently continue in existence and without falling to the ground,

"for many hours, usually moving in circles, resembling in the distance solid pillars of sand. I have frequently" (he says) "seen many such columns at the same time, in the boundless desert, all travelling, or waltzing, in various directions, at the wilful choice of each whirlwind: this vagrancy of character being an undoubted proof to the Arab mind, of their independent and diabolical origin." *

Nor indeed is this to be wondered at, seeing that

* *The Nile Tributaries of Abyssinia*, by Sir Samuel Baker, 1867, p. 23.

to the untutored mind, the only means of accounting for such strange and to them, of course, wholly inexplicable phenomena, is by assuming that they are the work of some evil spirit. The existence of these spirits is, moreover, frequently mentioned, both in the Korân and also in the Scriptures. Thus insanity is always set down in the latter to the evil spirit, and the individual is said to be "possessed of a devil." Both amongst the Arabs and the Red Indians of North America, this supposed supernatural character of mental disease causes these unfortunate persons to be regarded with great veneration, and in the East such persons frequently assume the saintly character of hermits, marabouts, and other devotees. The mind, in such cases, is supposed to be in heaven, whilst the body alone remains upon earth; and thus it comes to pass that these persons are regarded as the special favourites of heaven, and even crimes committed by them do not detract from their supposed saintly character, because the mind being abstracted from worldly things is believed to leave the bodily passions without control. *

Another remarkable feature of the desert, though it is by no means confined to these desolate regions only, is the hot wind, or "Simoom," as it is now generally called, though a variety of different names have been given to it, in various parts of the world.

There seems to be good reason to believe that these winds in all probability have their origin in the desert, which is supposed to act as the oven which gives off the heated air, which is then carried down over the

* *An Account of the Manners and Customs of the Modern Egyptians*, by Edwd. Wm. Lane, 5th Edition, p. 232.

inhabited and cultivated districts, by the agency of the prevailing winds. This is pretty conclusively shown, because during the prevalence of these hot winds, they are always found to blow from the quarter where the desert is known to exist. The continent of Australia for instance, is peculiarly subject to their influence, the whole of the temperate regions of Australia being periodically more or less affected by them, and some of the highest temperatures in the world have on such occasions been recorded there—the thermometer sometimes standing for days together, at from 100° to 115° Fahr. in the shade, and we have seen it a good deal more even than that.

The injury done to crops and pasture lands by these hot winds, is often most serious; the vegetation over large areas of country being burnt up, as if it had been exposed to the breath of a furnace—in the vicinity of the Hunter River in New South Wales, for instance, on one occasion the wheat crop was destroyed over some thirty miles of country. *

It is, however, generally believed that these intensely dry heats, though very oppressive, are not absolutely injurious to the health of human beings †—and even in the Desert the same fact has been recorded,—they are exceedingly unpleasant and trying, but do not seem to produce any serious illness. It is, of course, there that the Simoom is felt in its greatest intensity, and in the great Sahara, according to Count D'Escayrac de Lauture, the Simoom sets in shortly after the vernal

* See Stanford's *Compendium of Geography and Travel for Australia*, edit. by Alfred R. Wallace, 1879, pp. 31, 32. N.B. In January 1896 Australia was visited by a spell of hot winds for three weeks of almost unexampled intensity.

† *Ibid.*, p. 31.

Equinox—and blows, at each point, in an opposite direction to the Polar current, or counter trades, which are here passing overhead, as an upper current, in the higher regions of the atmosphere; and with occasional intermissions the Simoom continues to blow until the Summer Solstice.* This accounts for the fact that the Simoom (under the name of the "Sirocco"), though of course in a comparatively mild form, invades Southern Europe, and sometimes extends the sphere of its influence for a considerable distance inland—it is, for instance, occasionally quite distinctly felt all over Spain. as well as at Pau and other places in the South of France,

The characteristic features of this wind are, of course, its high temperature and extreme dryness, and in the desert, according to Count D'Escayrac de Lauture, it most generally blows in hot gusts, rather than as a steady breeze; almost as if the plain was being inundated by undulations of hot air—which forms so strongly marked a peculiarity, that the Arabs, who are keen observers of everything connected with the natural phenomena of their desert homes, have a saying "that wind at sea blows horizontally, while that of the desert jumps, and gallops, in excavating the sand." † It seems highly probable that this undulatory motion of the atmosphere is due to the uprising of waves of heated air, given off from the scorched surface of the sand, and gusts of wind, blowing in this manner, would evidently be likely to put the sand in motion, and carry a certain quantity of it up into the air, which afterwards falls in a rain of sand—while the lighter and

* *Le Dèsert et Le Soudan*, par M. Le Comte D'Escayrac de Lauture, 1853, pp. 28—9.

† *Ibid.*, p. 46.

finer particles in the form of dust, rise to an infinitely greater height, and are sometimes carried to extraordinary distances even out to sea.*

The propelling and carrying powers of the winds, as we know, are very great—so great, that it is impossible to place a limit to their capacity in this respect. "The red fogs" which navigators speak of, however, are known to extend many hundreds of miles to seaward. These fogs are caused by clouds of dust, known to seamen as "sirocco" or "African dust," which there can be little doubt proceed from the desert.

"It is of a brick red, or cinnamon colour (such being the colour of the sands throughout the Sahara), and sometimes comes down in such quantities as to obscure the sun, darken the horizon, and cover the sails and rigging with a thick coating of dust, though the vessel may be hundreds of miles from land."†

A remarkable instance of one of these extraordinary dust storms is related by Dr. Clymer, Fleet-Surgeon of the U.S. African Squadron, who reports that a "red fog" was encountered in February 1856 by the U.S. Ship "Jamestown" while far from any land—

"We were," says he, "immersed in the dust fog six days, entering it on the night of the 9th of Feb., in Lat. 7° 30′ N. and Long. 15° W.; and emerging from it on the 15th, in Lat 9° N. and Long 19° W. The red dust settled thickly on the sails, decks, etc., from which it was easily collected. It was an impalpable powder of a brick dust, or cinnamon colour, and the atmosphere was so dusky, that we could not have seen a ship beyond a quarter of a mile." §

* *Le Dèsert et Le Soudan*, par M. Le Comte D'Escayrac de Lauture, 1853, p. 47.

† *The Physical Geography of the Sea*, by Lieut. M. F. Maury, U.S.N., 16th Edit. p. 145.

§ *Sailing Directions*, by Lieut. Maury, U.S.N., 8th Edit. Vol. ii., p. 477.

Specimens of this dust have, on different occasions, been submitted to microscopic examination, and have been found to be composed of infinite numbers of minute infusoria, and particles of decomposed calcarious and feruginous rocks and shells.

An enquiry into the nature and composition of "dust" has of late years opened up an enquiry into many exceedingly important and curious questions: some of which have been brought prominently into notice by the modern germ theory of disease, and although such considerations are, of course, foreign to our present subject, we may just spare a moment to take a brief glance at the question of these countless myriads of minute particles, which are continually floating in the air around us, sometimes in a visible form, which we call "dust," but more often in an invisible form, so that their existence is unknown and unsuspected by the great majority of mankind. Most of us, however, will at one time or another have seen the still air of a dark room irradiated by a strong ray of light; and the infinite numbers of particles which are floating about in it, all of them in perpetual motion, can hardly have escaped our notice. If we observe them attentively, we shall see that though some of them appear to be merely floating in the air, there are others which may be seen jumping, rotating, and passing to and fro, in rapid motion; often against the set of the aerial current, or draught, and the motion of these latter particles is of so peculiar a nature, that they can leave no doubt upon the mind of the reflective student that they consist of living organisms—yet on admitting the light of day, the atmosphere of that room will appear perfectly pure, and free from dust:

in fact it probably is freer from dust than the exterior atmosphere near the earth's surface.

Some remarkable experiments of somewhat analogous nature to that just described were also recently carried out in London, in connection with the study of "Hay Fever." The object of them was to ascertain whether the pollen of certain species of grass (notably that of "Anthroxanthum Odoratum," a scented grass that principally gives the delicious aroma to our British hay), and other flowering plants, which are known to cause attacks of this affection, when inhaled by certain persons—could be detected in the atmosphere of central London. For this purpose slips of glass, coated with a film of adhesive matter, were exposed to the air during the hay-making season, in various parts of London, and the results of a microscopic examination of the adherent particles proved that even in the heart of London these glasses were generally more or less coated by the pollen of such plants, in considerable abundance. *

Pollen, we need hardly say, is the powdery substance produced in the stamens of flowering plants, it is one of the commonest of the vegetable substances found in the air, and the amount that is sometimes carried by the wind from place to place, may be judged of from a fact related by the late Mr. Charles Darwin, who states that the ground near St. Louis, in Missouri, has been seen covered with pollen, as if it had been sprinkled with sulphur, and there is good reason, he

* See Sir Morel Mackenzie on *Hay Fever and Paroxysmal Sneezing*, 4th Edit. 1887, pp. 45—7. (We must, however, remind our readers, that these two affections are distinct diseases of the mucous membrane, and that people suffer from the latter form of it who are in no way affected by hay-making.)

says, to believe this had been transported from the pine forests lying at least 400 miles to the South.†

Here we must cut short this digression on certain scientific aspects of "dust," the object of which, we need hardly say, has been to impress upon the reader the extraordinary and apparently illimitable capacity possessed by the atmosphere, both in calm and in storm, and whether in a clear, or in a misty state, of carrying particles of organic and inorganic matter to great distances.

The "red fog" which we have alluded to above, probably implies a condition of the atmosphere saturated with dust, carried by the wind from the desert. In these great sand storms, the wind in the desert generally veers about in an extraordinary way, and cross currents, proceeding from opposite directions, meet, and drive against each other, from perhaps two or three different quarters at once—and in this way the whirlwinds or sand-spouts are produced. In the vortex formed by the meeting of these opposing squalls the wind would naturally gyrate with extreme violence and rapidity, raising up, at each point where this occurs, those tortuous columns of sand and dust, so frequently described by travellers as "waltzing" across the surface of the desert.

Mr. Atkinson states, that when traversing the Mongolian Desert,

"In the middle of a space sown with innumerable hillocks of sand, we saw about thirty of them suddenly raise themselves around us, lengthen into long elliptical columns, and sweep over the surface of the desert with the hissings and contortions of gigantic serpents. These spouts varied in

* *The Effects of Cross and Self-Fertilization in the Vegetable Kingdom*, by Charles Darwin, 2nd Edit. 1888, p. 405.

diameter; the smallest measured between twenty and thirty feet; a few attained to 100; and one which absorbed in its vortex all that it approached rose to nearly 200. But soon the atmospheric forces which had raised them, beginning to fail, we saw these sand-spouts fall away one after the other, and form on the surface of the desert a number of hillocks similar to those from which we had just emerged."*

During the prevalence of the Simoom, excessive temperatures are not uncommon, as may be seen on reference to the chapter on Climates and Temperatures, where these matters are especially considered. These hot winds prove the more trying from the fact that, contrary to the usual rule in the desert, where the nights are generally cool, and often piercingly cold, there is little intermission of the great heat by night while these winds blow.

It is also a curious fact that on the hottest days the sun is at such times rarely visible, being almost always shut out by mist, † or if visible through the cloud of sand, it appears of a deep red colour and greatly exaggerated in size, doubtless because viewed through the medium of a more or less thick curtain of dust—even when no violent sand storm, such as we have just described, is blowing; this is a condition of things that may exist for many days together during the prevalence of the Simoom, and there can be little doubt that when the sun is described, in the Sacred Writings, as being "turned into blood" it is to this condition of the atmosphere that reference is made.

The experience of the surveying parties, employed

* *Travels on the Russo-Chinese Frontier*, by T. W. Atkinson.

† *Le Dêsert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, 1853, p. 47.

upon the surveys for the projected Soudan railway, was, that the months of April and May, which is the height of the Simoom season, were on the whole hotter than the month of June, though they found the average temperature of the latter month to be over 100° Fahr., the highest registered temperature of the year being 115° F. in the shade, which occurred early in May. * During these great heats, such is the intense hot dryness of the air that they tell us all objects felt hot to the touch, even to the paper on which they were writing; and all woollen articles became so strongly charged with electricity, that blankets when drawn over each other, blazed up like sheet lightning in the dark tents, and people drew crackling sparks from their beards, when drying themselves after a bath. †

Count D'Escayrac de Lauture also found that the skin becomes scaly, while the transpiration, excessive at first, is arrested. It reappears after drinking, but only for a moment, while the thirst is naturally excessive and the stomach can bear only very light nourishment. Slight headaches are also apt to be produced, but otherwise the health is not in general injuriously affected: on the contrary "wounds and ulcers," he says, "heal with wonderful rapidity, and many malarial and other affections disappear entirely--dysentery alone appearing to become aggravated, and some risk of "heat apoplexy" may also be occasioned." § Such seems to be the general consensus of opinion among travellers with regard to these hot winds.

* N.B.—During the Soudan Campaign of 1896 higher temperatures than this were registered, up to 122° F.

† *Desert Life*, by B. Solymos, 1880, pp. 15 and 16.

§ *Le Dèsert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, 1853, p. 48.

A few words upon the sun temperatures must not be omitted. Throughout the Desert Zone, the solar rays seem to acquire their maximum intensity; and it would be perhaps hardly possible by a mere verbal description to convey an adequate idea of their power: the nearest approach to it being probably experienced when visiting an iron foundry, upon the opening of the furnace doors; indeed, the simile "like the breath of a furnace" seems to be the regulation metaphor adopted by most writers for expressing their idea of the intensity of these desert heats, and it is notorious that the highest temperatures in the world have been registered in these regions. The scorching effect of the sun's rays in a perfectly dry atmosphere is a matter which has already been commented upon and explained in the chapter on "Climates and Temperatures," so that it will be unnecessary to discuss that view of the question at present.

The exceeding transparence and purity of the desert air, of course, afford full scope for the transmission of heat, and the refraction from the bare sand and stones also greatly contributes to magnify its scorching effects to a degree that becomes well nigh insupportable; it is one of those things in fact which must be experienced in a man's own person before its fiery intensity can be fully realized.

All rock, stones and metal work, such as gun barrels, etc., become so exceedingly hot, under its influence, that it is impossible to lay the naked hand upon them, and the feet appear to be treading upon heated embers, or rather as if wading in a sand furnace; * lucifer matches also can be lit by touching the sand with them,

* *Desert Life*, by B. Solymos, 1880, p. 17.

and Sir Samuel Baker expressly warns travellers, in these climates, of the danger of carrying them at all in their baggage, for fear of their becoming ignited and destroying the contents. *

During the progress of the surveys for the Soudan railway the engineers tell us that "people who worked with metal instruments, without gloves, got their fingers blistered—the mahogany tripods of the instruments were painfully hot, and an eyelid, placed too near the brass work of a telescope, was blistered: —this was, of course," adds Mr. Falkonberg, C.E, "in the sun temperatures between 150° and 180° Fahr." † The French traveller Duveyrier found even higher temperatures than these in the Sahara.

We might go on, were that desirable, to mention circumstance after circumstance in amplification of these details, respecting the extraordinary intensity of the sun's power in the Desert Zone; but we think that this would hardly add anything to the significance of what has been already stated.

Though the hour of maximum thermometric heat is about 3 p.m., it has been frequently remarked, that it is the slanting rays of the sun, towards sunset, which are found most trying; the Soudan railway surveyors confirm this opinion, and found that on these occasions "the sun hit them everywhere," as they turned about their instruments, and the lower the sun declined the more they seemed to feel it. § This, of course, only

* *The Nile Tributaries of Abyssinia*, by Sir Saml. W. Baker, 1867, p. 541. (Safety matches are less likely to ignite spontaneously, than common lucifers.)

† *Desert Life*, by B. Solymos, 1880, p. 16. ("Solymos" was the Arab name given to Mr. Falkonberg, the chief engineer.)

§ *Ibid.*, pp. 9—18.

shows that the human frame is a bad indicator as to actual temperature, because the heat of the rays of the setting sun are really far less powerful than those of the sun in the meridian. The closing in of night, however, brings instant and complete relief from all these troubles and proves a welcome blessing to the wayfarer.

Travellers will find coloured glasses, or goggles, a great relief to the eyes, from the refraction of the sun's fiery glare. They actually seem to make it feel less hot. Though less restful, neutral tint glasses have the advantage over the deeper coloured kinds of not interfering with seeing; blue has been found a better tint than green as a rest to the sight. It would be too long to consider here the much debated question of the best means of protecting the head, spine, etc., from the sun during desert marches, which is an art in itself.

We may, however, just briefly mention that the best of all head-dresses for Europeans in our opinion is the Indian pith or Sola-reed helmet which, being very light, should be quite half an inch thick; while the spine should be protected by a thick pad of cotton, sewn to the clothes down the centre of the back. A loose white Arab "*burnous*" (a species of short cloak), which hangs from the shoulders, affords considerable protection from the sun. This burnous has a hood which can be drawn over the head at the will of the wearer. The Bedouin dress always comprises a turban and burnous fitted with a hood of this description, the head being further protected by a thick rope of camel's hair wound around the temples. A "cummerbund" or waist girdle is also useful to protect the stomach, and to afford support to the back during the fatigue of camel riding.

The remarkable effects of the combination of intense heat and drought in these regions, in arresting the progress of decomposition of animal tissues, to which we before alluded, are well illustrated in the case of the ancient Egyptian mummies, concerning which we must find space to say a few words. In damp climates of course the conservation of those remains, during thousands of years, would necessarily be impossible—even were it desirable. The art of embalming, we need hardly say, arose out of the religious belief in the future resurrection of the body, and as the body was to live again it followed as a logical sequence that no pains could be esteemed to be too great which could contribute to preserve these frail remnants of mortality both so as to ensure their unbroken rest and their immunity from decay—and there can be no doubt that it is to these selfsame causes that we owe the creation of those enormous structures, the Pyramids, as well as most of the other great works of Egyptian antiquity, which date from what at present seems to be the dawn of history.

The tremendous waste of human life that the execution of these gigantic works, under a system of forced labour, involved, is a matter of history. The living being sacrificed to the dead in this wholesale manner, so greatly excited the abhorrence of the Mohammedans, that to their honour be it said, they have to this day always designated the pyramids as "*El Harâm*"—signifying in Arabic "The Forbidden" or "The offence against religion"—for it may now be accepted as a matter of ascertained fact that the Pyramids were created "as tombs, and nothing but tombs."* The investigations

* See Murray's *Handbook for Egypt*, 8th Edit. 1891, p. 235.

of the late learned Mariette Pasha and others seem to be decisive upon this point.

Then as regards the process of embalming. When a great man died it was accounted necessary that the body should be thus preserved for the reasons already stated, though the return to life of the discarded remnants of mortality, bearing within themselves the seeds of mortal disease and decrepitude, was like the putting on again of a worn-out garment, no longer fitted for its wearer's use.

The body, however, having been placed in the hands of the embalmers, who formed a regular guild in ancient Egypt, was then, according to the account handed down to us by Herodotus,* opened, the intestines removed, and the cavities of the body filled with myrrh, cassia, and other perfumes; it was then sewn up again, and steeped for seventy days in "Natron"—that is to say in Saltpetre or impure Nitrate of Potash—and it was upon this pickling process, we need hardly say, that the success of the embalming mainly depended—for the effects of spices and perfumes would have been without avail—and at the expiration of the seventy days (this being the limit of the period during which it was lawful to steep the body) it was wrapped in bandages, smeared over with certain fragrant gums to exclude the air. The process was then complete.

The intense dryness of the climate and the drifting sands of the desert did the rest, and the mummies were then laid to rest in magnificently ornamented cases, in sepulchral chambers mostly hewn in the solid rock, known among the ancient Egyptians as "The

* See Herodotus, Book II ("Euterpe"), cap. 86.

Eternal Abode," for according to the historian Diodorus Siculus the house of the living was regarded by the Egyptians merely as "an hostelry." It mattered little in their opinions what became of it *; but the tomb, on which they lavished all their powers of ornamentation, was the place of permanent abode. Then came the drifting sand, which blew in from the desert, and covered everything over, so that for thousands of years it has hermetically sealed up these wonderful places of sepulture, so that many of them have been thus preserved inviolate, not only from desecration by human plunderers, but from the effects of atmospheric changes, to the present day, with all their ornamentation, paintings and inscriptions still existing as clearly cut and as bright and fresh as upon the day when the mummy was placed there.

As regards the wonderful completeness of this process of preservation through the exclusion of the atmosphere by the sand drift, we may mention a remarkable instance of the way in which even the most unstable impressions may be preserved, when undisturbed. It was noticed by some of the explorers, on entering for the first time into some of these ancient sepulchral chambers, hitherto unviolated, that the footprints of the slaves who had carried in the mummies, thousands of years before, still remained visible upon the sand which covered the floors. †

It would be beyond the scope of this work to enter

* The Korân has very beautifully expressed its views upon the future state as follows towards the close of Sura xix: "Verily this present life is no other than a toy or a plaything, but the future mansion of paradise—that shall be life indeed." (See Sale's *Korân*, and other English translations).

† See *Nile Gleanings*, by Villiers Stuart, M.P., 1880, p. 31.

into any lengthened statements respecting Egyptian antiquities, or the subject of mummies in general. We need only refer to recent great discoveries of Royal mummies, at Deir-El-Bahari, near Thebes, which occurred in July 1881, a short account of which will embody every point of interest.

The contents of the vault when discovered, were found to consist of thirty-six Royal mummies enclosed in splendidly gilt and decorated caskets, and an immense number of funeral offerings and other articles, such as Osiris statuettes, boxes, chests, vases, papyri, etc., belonging to the XVII, XVIII and XIX Dynasties,* which covers one of the most brilliant epochs in Egyptian history. Prominent among these may be mentioned the mummy of Thothmes III of the XVIII Dynasty, one of the greatest conquerors Egypt ever produced; and of Ramses II of the XIX Dynasty, better known as "The Pharaoh of the Israelitish oppression" and also as the great "Sesostris" of the Greek historians, who is supposed to have lived about 1330 years before the Christian era. The mummy of this celebrated man, without doubt the greatest figure in the long line of the Pharaohs,† who died at the immense age of nearly 100 years, and who is said to have reigned over Egypt for a period of sixty-seven years, was unrolled by order of the Khedive in June, 1886. It is described as being "extremely well preserved, and one of the best examples of the Egyptian embalmers' art." § It is now in the Museum of Antiquities at Gîzeh, near Cairo, and the face, as those who, like ourselves, have had the privilege of

* See Baedeker's *Handbook for Upper Egypt*, 1892, p. 229.
† *Encycl. Brit.*, 9th Edit., vol. vii., p. 739.
§ Murray's *Handbook for Egypt*, 8th Edit., 1891, p. 198a.

viewing it, can attest, after the lapse of considerably more than 3000 years since his death, could in all probability be still easily recognised by anyone who had known him in life. The attitude and expression is that of dignified repose and the face still bears the traces of considerable intellect, and possesses a somewhat aristocratic cast of countenance, with high forehead, sharply chiselled features, and curved nose. In some of the other mummies, however, the process of embalmment had proved less successful, and they crumbled to dust on being opened.

We cannot call to mind any circumstance that has ever come under our notice, which exhibits in so striking a manner the strange vicissitudes which time produces, or the hollowness of human greatness and glory, as this exhibition of the mouldering remains of a once renowned sovereign (as a public show), who had formerly ruled over the land with absolutely despotic power, at a time when Egypt was justly regarded as the mistress of the east. These sentiments have been so well expressed in some verses, written upon the subject of this celebrated mummy by a young Australian poetess (who was herself soon afterwards snatched away by death in the flower of her youth), that we have no hesitation in reproducing the opening lines, which run as follows:—

"Pharaoh Lives for Ever"

[Lines suggested by a Photo of the mummy of Ramses the Great.]

"Most Mighty Monarch can it ever be
That thou, sun of sun's, giv'r of life, shall be,
Torn from thy tomb, thine unguent scented shrouds,
And set, drear sight of death, to gaping crowds,

While safely hidden in their unknown graves,
In quiet sleep the meanest of thy slaves.
"For Pharaoh lives for ever!" their taskmen cried:
"For ever Pharaoh lives!" thy slaves replied:
And with the lie upon their lips they died."*

And so this is the ultimate result of all his regal splendour. He, whose word was once actually law to millions of the human race. Well may we ask ourselves: *What* would be the feelings of the dead King, could he only come back again, to see himself as he is now seen—the occupant of a show-case in the Hall of the Royal Mummies in the National Museum of Egypt?

A few more details illustrating the wonderfully preservative effects of the dry climate of Egypt and we have done. It was the custom, at the funerals of the great, in those days, to decorate the mummy with garlands of flowers, and when the coffins were opened, they were found to be filled with these floral offerings, and though the bodies had in some cases mouldered into dust, the flowers with which they had been decorated were so wonderfully preserved, that in many cases their colours were still perfectly distinguishable, "and looked as if they had only recently been dried; yet a flower is the very type of ephemeral beauty that passeth away, and is gone, almost as soon as born."† Several varieties, however, were able to be recognised, and the plants they were taken from named by Professor Schweinfurth:§ among others were the blue lotus

* *In Sunshine and Shadow*, MSS. poems by Miss Inez. K. Hyland, publ. Melbourne 1893, p. 4.

† *Egypt After the War*, by Villiers Stuart, M.P., 1883, p. 185.

§ Baedeker's *Handbook for Upper Egypt*, 1892, p. 229.

flower, and those of the yellow mimosa, which are still common in Egypt; whilst other varieties were found to be from plants that do not grow in Egypt at the present day. Curiously enough also, when the coffin of Amenhotep, a King of the XVIII Dynasty who lived quite 3500 years ago, came to be opened, it was found that a *wasp*, which had evidently settled upon the flowers when the coffin was being closed, had been shut in and still existed, dried up, but quite perfect, the insect having lasted better than the King, who lay in regal state beneath.*

It will therefore scarcely be surprising to find that the woodwork of many of these coffins, together with the gilding, paintings, and varnishing, with which they were all magnificently decorated, both inside and out, are still in a most complete state of preservation and apparently as bright and perfect as if the work had only just been executed. Some of the portraits of the occupants are admirably painted. In one instance the face of a beautiful girl is preserved in this way, who, from her features, might have been quite a good-looking English girl of the present era.

When the coffins containing these royal mummies and the treasures brought to light in this famous find, had been taken to Luxor, and placed on board a vessel for conveyance to Cairo, an affecting instance of loyal attachment to the memory of the illustrious dead was exhibited by the poor fellâhin of Egypt, such as is probably unique in history.

As the vessel containing the remains of their ancient sovereigns started upon its journey, its departure was witnessed by a vast crowd of natives assembled upon

* *Egypt After the War*, by Villiers Stuart, M.P., 1883, p. 185.

both banks of the Nile. The women, with dishevelled hair, uttering plaintive cries, and wailing, according to the ancient custom of eastern mourners; whilst the men fired off guns, as when rendering the last honours at the funeral of some distinguished personage; and the vessel was thus escorted as far as Koptos, a distance of some thirty miles down the river. *

As Mr. Villiers Stuart has remarked—"surely a more touching tribute was never paid them, even at the height of their power, than this spontaneous outburst of feeling from the hearts of the people. After centuries of oppression, they still cherished traditions of the splendid past, when monarchs of their own led them to victory, and made their country, through long ages, the mistress of the East." †

This incident shows how immortal are the traditions of national glory. More enduring than the marble that builds the shrine, its lustre is undimmed by the lapse of ages. Empires have risen and fallen—great nations have been born, have flourished, and passed away, whilst these mighty men of old slept fast, in that great untroubled sleep of more than 3000 years; during which the deathless fame of these ancient heroes still lived unforgotten and untarnished, in the hearts of the people.

Remarkable, too, is the fact that though the reigns of these princes were generally stormy—and though the world itself may then have seemed too small for their ambition, and though extravagance, misrule and oppression were the general characteristics of their government—the records of their faults and their follies have been

* See Baedeker's *Handbook for Upper Egypt*, 1892, p, 29.
† *Egypt After the War*, by Villiers Stuart, M.P., 1883, p. 172.

forgotten, whilst that which was great among them has proved immortal.

So may it be with us all.

Among the phenomena witnessed in countries subject to the influence of a powerful sun, that of mirage is undoubtedly one of the most notable. It is, however, by no means confined to sandy deserts, as is generally supposed, though it is often seen there in its most strikingly wonderful forms, being evidently created by waves of highly rarified air, thrown off by the intensely heated ground.

Mirage is, therefore, always strongest close to the surface of the earth, where its vibrations have the effect of so greatly distorting all natural objects in the landscape, that their transformation is often so complete as to produce an optical illusion of the most remarkable kind. Mirage may, however, be seen on the surface of water, in lakes, and lagoons, and even at sea it is by no means uncommon. Thus, not long ago the newspapers reported the loss of the American barquantine 'Steadfast' wrecked on the island of St. Croix, while on her way from Trinidad to Philadelphia with a cargo of asphalt. The crew report that the wreck was caused by mirage, which made the island seem many miles away, when the vessel was close to the reefs." *

We may also mention that while crossing the great Australian Bight, we have ourselves been a witness to one of the most wonderful instances of marine mirage which could be imagined. The event took place from 5 to 6 p.m. on January 11th, 1895, when our ship was over 100 miles from any land. The

* *The Times* of Nov. 11th, 1891, p. 13.

low dark outline of a distant coast seemed to encircle the vessel, about 3 miles away (apparently), little hills and clumps of trees seemingly growing on the hill sides were clearly seen. At one place a large black pillar like that of some great building, rose directly out of the sea, which some on board thought to be a water spout. Finally a line of surf, exactly like heavy white breakers beating upon the coast, seemed to burst over nearly the whole of this phantom land, and presently the whole panorama disappeared like a mist, after remaining visible a little over one hour—leaving the offing quite clear, without a single object in sight but the restless ocean.*

Mirage may, in fact, occur, under certain conditions of the atmosphere, almost anywhere; and at times it assumes every sort of fantastic shape. Sometimes inverted representations of trees and other terrestrial objects appear, as it were, floating in the air upside down. At other times the same objects are evidently multiplied as if several times reflected, one above the other, the intervals being apparently occupied by sheets of water.

Visions of phantom waters are, in fact, one of the most common illusions in mirage, and occasionally refraction is so powerful as to render every natural feature of the landscape entirely invisible—the surface in such cases appearing to be submerged beneath the glittering waters of a shallow lake, above which some of the larger objects protrude, as if its surface was studded with numerous islands:—even the heads of camels and other animals are sometimes seen on

* Personal observations taken by the Author on board the P. & O. R.M.S. 'Arcadia,' 6800 tons, Capt. A. C. Loggin, off South Coast of Australia, January 11th, 1895, in *about* Lat. 35° 40′ S., Long. 132° 30′ E.

these occasions, as if swimming in the water, beneath which their bodies are completely hidden from view.

The most beautiful effects are often produced, conjuring up images of distant views of lovely scenery, such as sheets of water bordered by groves of beautiful trees, where nothing exists but a waste of burning sand; or again the mimic scenery may represent the stately outlines of ancient castles, palaces, cathedrals, and other buildings erected by human hands—thus affording a practical illustration of the poetic idea of "castles in the air."

All these things, however, are nevertheless in all probability merely distorted images of natural objects, having an actual existence in the landscape, reproduced as already mentioned in an exaggerated form by the vibrations of highly heated, rarefied atmosphere—thus a flat waste of sand sparkling in the intense light of the solar rays, or a plain somewhat whitened by saline efflorescence, is made to represent the glassy surface of a lake; while a thorny fringe of dwarf acacias, or other shrubs, and even tufts of grass, become magnified and made to do duty for belts of fertile woodlands growing upon its banks; so also rocks and other irregularities of surface may readily be conceived to form the fabric out of which a city of palaces appears to rise, as if by enchantment, from the stony wilderness.

To the untutored minds of the desert nomads, of course, such things can only be accounted for by supposing them to be the work of evil spirits: and probably nothing has done more than the phenomena of the mirage to invest the oriental mind with a superstitious belief in genii and other supernatural agencies. The mirage in fact is often spoken of among the Arabs as the "*Bahr-es-Sheitân*," or "The Waters of Satan."

We may also state that in the course of our studies on these and kindred subjects, it has often struck us that the origin of the famous Greek mythological idea, of "LETHE" (λήθης ὕδωρ), or "The Waters of Oblivion," also took its rise from the phenomenon of the mirage. These remarkable phantasma of the desert, as we have already shown, conjure up all sorts of delusive representations, only, as if in mockery, to snatch them away again from the beholder's view, leaving the bare surface of the "Bahr-Belâ-Ma," or "Waterless Sea" of the Arab writers, alone remaining, as the stage whereon they had been just before displayed.

So also, according to the poetical fancy of the ancient belief, these waters of the stream of Hades, once carried to the lips, caused those who drank of them straightway to forget everything they had seen or heard or done, in a previous state of existence (it may be with a nearer approximation to truth than any of us fancy). These things washed out by the waters of oblivion, disappeared like the phantoms of the mirage, as completely as though they had never been:—precisely as the spectres of the desert vanish from the fevered gaze of the weary traveller. The idea, however, of memory being blotted out by water during a future existence, is one which runs through some of the very earliest records of mankind, and it existed in the ancient Egyptian mythology at a very remote period. Thus water has among other things been supposed to be capable of washing away the memory of offences, so that they become effaced and as if they had never existed.

The strange phenomena of the mirage could hardly fail to produce a profound impression upon the unedu-

cated mind, represented as they are with such wonderful realistic effect, that it is hard for the spectator to persuade himself that the whole thing is simply a phantom scene, set upon the stage of the great theatre of Nature; and an optical illusion only.

Remarkable, therefore, is the fact that however completely these unreal pictures may impose upon the boasted superiority of our human senses; they have never been known to do so upon the supposed duller instincts of the wild animals, who are the inhabitants of the wastes. Dogs are alleged to have been sometimes deceived by it, but this is a doubtful point and may have arisen from the animals wandering off in search of water. It is well known that dogs and pigeons will occasionally take the reflexion of themselves in a mirror which is held up before them, for that of some other member of their fraternity. The author, on one occasion, nearly had a valuable pier glass smashed, when playing this trick upon a favourite bull terrier. Still, after a careful examination of this curious subject, he has been unable to find any trace of an instance where wild animals are known to have been deceived by mirage: yet it is hardly to be supposed that the images of cooling waters and sheltering groves, would be invisible to their penetrating gaze; or that what is so plainly visible to the human eye, could be hidden from the eyes of the thirsty camel or the desert antelope.

Nevertheless, notwithstanding his superior genius and wisdom, man seems, of all created beings, to be the most easily taken in by it, and many instances have been from time to time recorded of his falling a victim to his own delusions by following these

phantoms of the desert, only to find that they are nothing. One might, for instance, have supposed that in Egypt, at any rate, everybody would have been more or less familiar with mirage, and that people would have been less liable there, than elsewhere, to be deceived by it, yet Sir Samuel Baker in his "Nile Tributaries of Abyssinia" relates the story of the total loss of an Egyptian regiment in this way. This catastrophe occurred about 1820 on the section of desert between Korosko and Abou Hammed, of which we have already spoken: where the caravan route cuts across the chord of the arc formed by the great bend of the Nile between these points. Sir Samuel Baker gives the following account of the disaster:

"Many years ago, when the Egyptian troops first conquered Nubia, a regiment was destroyed by thirst in crossing this desert. The men being upon a limited allowance of water, suffered from extreme thirst, and deceived by the appearance of a mirage that exactly resembled a beautiful lake, they insisted upon being taken to its banks by the Arab guide. It was in vain that the guide assured them that the lake was unreal, and he refused to lose the precious time by wandering from his course. Words led to blows, and he was killed by the soldiers whose lives depended upon his guidance. The whole regiment turned from the track, and rushed towards the welcome waters. Thirsty and faint, over the burning sands they hurried .... farther and farther from the lost track where the pilot lay in his blood: and still the mocking spirits of the desert, the afreets of the mirage, led them on, and the lake glistening in the sunshine tempted them to bathe in its cool waters, close to their eyes, but never at their lips. At length the delusion vanished—the fatal lake had turned to burning sand!"—"Not a man ever left the desert, but they were subsequently discovered,

parched and withered corpses, by the Arabs sent upon the search. *

Here the remarkable words of the Korân instinctively rise up before the mind's eye, where the Moslem prophet skilfully availing himself of the apparently supernatural phenomenon of the mirage, so constantly witnessed by his followers in these sun-stricken regions, thus figuratively applies it to represent the state of the infidel and says, "The works of the incredulous are like the mirage (*Es Serâb*) of the plain; the thirsty man taketh it for water, until he draweth nigh unto it, and then he findeth that it is nothing." †

The angle of refraction, in fact, becomes altered as the observer shifts his position, till at length the illusion dispels itself by suddenly vanishing, and instead of cooling waters, the dry and barren desert stands revealed as one vast sandy ocean, covering the face of Nature.

Such is sometimes the effect of seeing things from a different point of view! How often do we find it so in everyday life, and see people chasing some phantom, the supposed ideal of complete felicity, only to discover, should some few of them succeed in approaching it, that it vanishes like the mirage, or else turns out to be something altogether different to what they expected.

Probably one of the most remarkable instances on record, of travellers being deceived by the mirage, is quoted in the History of Australian Exploration, as occurring on the borders of Lake Torrens, South

* *The Nile Tributaries of Abyssinia*, by Sir Samuel Baker, 1867, pp. 12 and 13.

† The Korân of Mahomet. Sura xxv.

Australia, in April 1857, when an exploring party, conducted by the Deputy Surveyor General of the colony, was completely taken in by it. Ascending to the summit of a hill "to the north he saw a belt of gigantic gum trees beyond which appeared a sheet of water, with elevated lands on the far side, while to the east was another large lake." These on further examination, however, were found to consist, the gigantic trees of stunted bushes, and the elevated lands, of clods of earth. But the greatest surprise was when the party reached Lake Torrens. The water was found to be quite fresh, and appeared to stretch away "for fifteen or twenty miles to the north west, with a water horizon; there was an extensive bay to the southward, while to the north a bluff headland, and perpendicular cliffs were clearly discerned by a telescope." But having no boats with which to navigate the lake, the surveyor returned to Adelaide to report his discovery which created great rejoicing, as the northern frontier had till then been supposed to be a waterless desert. The Surveyor General immediately started, with boats, to explore the newly-found waters. The public disappointment at Adelaide may be imagined, when a letter was received from this officer reporting that "the cliffs, the headlands, and the grassy shores were all built upon the basis of the mirage," and that the lake had already receded half a mile, and was in no place over six inches deep, being evidently a mere flooded lagoon. *

Before dismissing these phenomena of the desert

* *The History of Australian Exploration*, 1788 to 1888, compiled from State documents by Ernest Favense, published Sydney 1889, pp. 189 and 190.

from our consideration, it is, we think, desirable to remind the reader how greatly the extreme transparency of the atmosphere, the spacious grandeur, uniformity and emptiness, of these boundless plains, tend to produce various kinds of optical illusions.

This is very forcibly brought home to the mind when attempting to estimate the distances, or dimensions, of objects seen in the landscape. There is generally nothing to guide the eye, and for want of any standard of comparison, everything appears to be much nearer than it is in reality. All guesses respecting distance, etc., are therefore sure to prove very wide of the mark. Thus mountains which, at sunrise, stand out with extreme distinctness against the sky line, at apparently no very great distance away, will often actually seem to recede before the traveller, throughout the day's march, and not uncommonly disappear altogether during the afternoon, in the quivering haze refracted from the heated ground, but only to reappear again the next morning, as if they had again advanced to meet the observer.

This phenomenon which is probably familiar to most travellers who have had much experience in plains-travel, is peculiarly noticeable upon the extensive table lands lying near the base of the Andes in South America, where the Cordilleras often appear to rise out of the plain a short distance ahead, while in point of fact they may be 60 or 70 miles away.

In the peculiarly clear atmosphere existing upon dry elevated plains, mountains are frequently visible at distances which would be thought incredible in damp tropical or temperate climates, where the horizon is always more or less misty.

From the decks of steamers proceeding along the

western coast of South America, for instance, magnificent views of the Cordilleras are almost constantly visible; the outlines of these sublime heights standing out with marvellous distinctness in the serene and often cloudless atmosphere; yet as a rule they cannot be less than from 100 to 120 miles distant, and at times considerably more than this. The same thing has been noticed by travellers in approaching the Himalayas from the plains of Northern India, for we are assured on competent authority that the snowy peaks of this gigantic mountain range "are, under favourable circumstances, visible from the plains, at a distance of about 200 miles." *

On the other hand it will be easily understood that when there is mirage, or haze upon the horizon, far off objects, such as distant mountains, may be entirely shut out from view. A man, for instance, may sometimes reside at Dover or Folkestone, for weeks, without seeing the coast of France, which is plainly visible on favourable days. In the same way Mr. Stanley in his late work upon the "Emin Pasha Relief Expedition," when alluding to this subject says:

"It requires a peculiar condition of the atmosphere to see mountains from a distance of 70 miles:—in such a humid region as this is, on a bright day, such a quantity of vapour is exhaled from the heated earth that at 30 miles it would be intensified into a haze no eye could penetrate. But at certain times, wind currents clear the haze and expose to view objects which we wonder we have not seen before. Returning to Fort Bodo, I took compass bearings of a lofty mountain and I noted it down, but I have never seen it since, though I have been twice over the ground." †

* *Encyclop. Brit.*, 9th Edit., Vol xi., p. 324.

† *In Darkest Africa*, by H. M. Stanley, 1890, Vol i., p. 407.

A few words upon the phenomena of the desert night will bring this branch of our subject to a close. It is the period of the twenty-four hours, when, according to common consent among travellers in these regions, perfect enjoyment crowns the labours of the long and sultry day with gladness, bringing with it a feeling of ineffable repose and peace. The transition from the fiery splendour of the day is of course a thing quickly accomplished in these latitudes: twilight being confined to a few brief moments only:—and except during the prevalence of hot winds, the advent of the night is succeeded by a complete and immediate relief from the exhausting heat of day—and there are no mosquitoes or other insect pests to give trouble in the Desert Zone, except perhaps in a few of the oases, the air being too dry for these creatures.

The rapid fall of the thermometer which follows sunset, is a matter fully commented on in the section on "Climates and Temperatures" as being a universal and necessary consequence of the extreme dryness of the desert air; where even dew is often found to be completely or almost completely, absent; as evidenced by the well-known fact, testified to by many travellers, that firearms may, during the dry season, be left upon the bare ground, night after night, without contracting a particle of rust. *

Throughout the sand plains, the dry sand which has

* Thus in a letter of the *Times* Correpondent with the Soudan Expedition of 1896 it is related that the caravan he was travelling with discovered the skeleton of an Arab, supposed to have died of thirst in the desert. Near the body was found a military rifle which was afterwards identified as having been stolen some two years before from one of the Soudanese Regiments. The wood work of it was much blanched by weather, but the barrel and iron work were quite free from rust. See the *Times* of June 2nd, 1896.

been heated to perhaps 130° or 140° Fahr. during the day, retains its heat for a long time, and even when it cools upon the surface, feels quite warm two or three inches below it when turned over. In rocky districts also, the hot stones continue to give out a sensible degree of heat for many hours after sunset: indeed for a considerable time afterwards, the incautious traveller sitting down upon a rock in thin clothes, is often startled to find it most unpleasantly hot. Nevertheless, though everything may be glowing like a furnace at sundown; the atmosphere rapidly cools down, and the nights are therefore generally cool and pleasant, and towards morning especially, not unfrequently become bitterly cold. Sultry and oppressive nights, when they occur, are usually experienced only during the prevalence of the hot winds.

The sudden diminution of temperature in dry regions, by night, is, however, a matter which every prudent traveller will do well to guard against by following the fashionable custom, even in these wild solitudes, of "dressing for the evening" in garments suitable to the occasion. The frame debilitated by the exhausting heat of day is keenly sensitive to chill—and he will be apt to find the protection of thick warm things, and even an ulster, none too much for him; some travellers have even gone so far as to recommend furs. Mr. Falkonberg, one of the engineers employed upon the survey of the proposed Soudan Railway, for instance, bitterly complains of the bad advice with which he was favoured by inexperienced friends, when making up his kit for the Egyptian Soudan, and says:—

"Our great surprise was to find the nights in December and January as cold as 45° F., on a rough average, never

so much as 50°, and in three nights as near the freezing point as 38½°, 37½° and 36°. My first annoyance was due to an error all are liable to. I asked and listened to some one I had thought expert, persuading me to leave in London the furs I desired to bring. I am often favoured with advice of this kind before starting on journeys" *
and unfortunately errors of this sort cannot afterwards be remedied by the traveller.

Mr. Falkonberg goes on to give a resumé of the experiences of former travellers in this respect, and states that "Duveyrier registers frost twenty-six times between December and March, in the plains of the Central Sahara. Bromfield speaks of sharp hoar frost, and ice a quarter of an inch thick, at Rhoda, on the Nile, in 28° Lat. The Imperial Gazetteer says as much about Syene. Durham and Clapperton mention hard frost, occurring at 13° Lat. in the Southern Sahara. Captain Lyon records six degrees of frost in the Libyan deserts," and so forth. †

These vast dry plains are also visited by piercingly cold winds during the winter season—these Northers appear to be prevalent at this season of the year everywhere throughout the Desert Zone in the northern hemisphere, and corresponding phenomena are also met with in the southern hemisphere, during their winter season. Mr. Falkonberg states in the Nile Deserts that during the first two months of his service there (Dec. 1875 and Jan. 1876) these winds blew steadily for several hours in the mornings—this qualification of the expression "burning desert," he reminds us, does not seem generally known,—the

* *Desert Life*, by B. Solymos, 1880, pp. 12, 13.
† *Ibid.*, p. 11.

intensity of the cold being such that he says "rugs alone, especially cloth rugs, are 'nowhere' in this weather," and he appends in a footnote, some sarcastic observations, respecting "the learned and expert gentlemen who undertook to furnish a stately paper on the 'Personal Equipment of Officers' in a volume of the United Service Institution where they say offhand, 'one needs no warm clothes whatever in Egypt.'" * Our own personal experience is, that without proper warm clothing, people run a very good chance of getting congestion of the lungs, and perhaps becoming dangerously ill. In Spain, which is very subject to these keen dry winds, the Spaniards have a proverb, often used in Madrid, to the effect that

"El aire de Madrid es tan sotil
Que matá a un hombre, y no apaga á un candil,"

that is, "So subtle is the air of Madrid, that it kills a man, and does not put out a candle." Such is a literal fact, within our own cognizance. Instances, we regret to say, are not uncommon, of a beautiful Spanish girl going out to a ball, during the prevalence of these icy winds, being struck down by pneumonia on returning home, and being dead and buried within a week. So also in the Egyptian deserts, with an intensely bright hot sun, there is sometimes an air so keen, that the instant one enters the shade it cuts like a razor, and penetrates right through the thickest clothing, and this continues to blow for many days at a time.

There can be no doubt that these hasty conclusions and generalizations upon the subject of natural phenomena about climate must often prove a subject of regret

* *Desert Life*, by B. Solymos, 1880, p. 12.

to the careful student, who not unfrequently finds himself unwittingly led astray by them. The existence of these cold winds in the Desert Zone, so far as we are aware, has long been a matter of well ascertained fact, and the comparatively limited area of the desert in northern Mexico and Texas, may be cited as an example of a region peculiarly subject to the visitation of these "cold snaps" as they are there termed. Similar experiences are noted from the great Central Asian deserts, as indeed from all other dry barren regions.

There is hardly much room for doubt that the cause of the sudden transitions from heat to cold, in the case of these cold winds, is the displacement of a warm undercurrent by a cold layer of air descending from the higher regions of the atmosphere, as we have had occasion to point out elsewhere—while the rapid chilling of the still air by night is due to radiation and absence of aqueous vapour. Count D'Escayrac de Lauture mentions the fact of his observing on one occasion, during the month of January, under the 17th parallel of latitude, the thermometer which at sunrise marked a temperature of only 5^0 Celsius (= 41^0 Fahr.) rising to 35^0 Celsius (= 95^0 Fahr.) by 1. p.m. the following afternoon, thus showing the enormous variation of 30^0 Celsius (= 54^0 F.) in only seven hours. The human frame, he says,

"has not time to accustom itself to these sudden changes, the cold of the night seems insupportable and the heat of the day overpowering; these two temperatures are nothing excessive in themselves, but the human body, able to bear the winters of the Polar regions, and the summers of the Soudan, does not bear equally well the sudden transition from the temperature of a night in France to that of a day

in India; nevertheless it does not occasion serious illness, but only a certain feeling of suffering in the early morning and of fatigue by day," and "the summer, which is less healthy, and of which the heats are excessive, seems less invigorating than the winter."*

The comparative coldness of the desert nights, of which we have thus far only noticed the disadvantages in order to point out the necessity for travellers to be always provided with a sufficient stock of warm clothing, has on the other hand advantages which must by no means be forgotten.

When the cold is not extreme, and proper precautions have been taken to guard against its effects, there can be no doubt that it acts as an admirable tonic, and generally secures refreshing sleep after the exhaustion caused by the great heat of the day. The nights are for the most part generally fine and unsurpassed for the delicious purity and perfect transparency of the atmosphere. There is no dew to dampen clothes: one remains therefore perfectly dry, and owing to the total absence of cloud the deep azure of the celestial vault is to be seen spread forth in the serene altitudes, radiant with countless myriads of stars, which here shine with almost phenomenal lustre. Towards the full of the moon also the moonlight is possessed of an extraordinary brilliancy. There is, therefore, when the nature of the ground is favourable, generally but little difficulty in travelling by night, especially when traversing the interminable plains which occupy so large an extent of country in the Desert Zone—the Arab guides being adepts in the art

* *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, Paris, 1853, p. 20.

of conducting the march by the aid of stars, which long practice enables them to steer by as effectively as the helmsman on board a ship at sea can do by compass. In the hot weather also, the camels travel better by night, especially if the desert supplies them with occasional tufts of scanty herbage which they can crop as they pass them by; this their long necks enable them to do without stop or difficulty: they also eat with better appetite than during the day when halted. *

It is a well ascertained fact that these animals do not like grazing during the great heat of the day, the morning at a very early hour is the time they prefer for feeding, or else by night. It has been frequently observed that when a halt is made for a short time during the day, camels merely profit by it to rest themselves, and not to feed unless their appetite is excited by the sight of some fresh and succulent herbage, or that they are refreshed by a little water. †

That being so, it is the practice of the Arab guides, and one generally followed by experienced travellers like Count D'Escayrac de Lauture, to time their departure for a long march across a waterless desert, as far as possible, for about the seventh or eighth day of the lunar month, so as to take full advantage for at least a part of the night, of the clear moonlight § which in these regions bathes the surface of the waste with a lustrous flood of silver light—so clear and beautiful that the traveller as he goes along can easily note all

* See *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, Paris, 1853, p. 619.

† Dr. Gustav Nachtigal, *Sahara et Soudan*. Vol. i., p. 135, from the French translation from the German by Jules Gourdault, Paris 1881.

§ *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture p. 617.

the features of the country, at considerable distances, almost as readily as by day. Even good-sized print is sometimes quite legible. *

Count D'Escayrac de Lauture states that on these occasions he used to set out upon his journey about 3 o'clock in the afternoon, that being the hour after which the heat begins to decline, and he continued his march until the setting of the moon. † He then encamped for the remainder of the night, and the camels were fed on grain, or if there was grass, could graze during the early hours of the morning. Then, an hour and a half before sunrise, or thereabouts, the order was again given to load the camels and resume the march until about midday. These questions as to the conduct of marches, however, depend on a number of technical considerations; here therefore it will be sufficient to note that the longer the moonlight lasted by night, the less the count travelled by day. § In this way he was able to make his passage with the maximum of speed and the minimum of suffering both to the men and animals. In crossing extensive tracts of waterless desert where the grim spectre of thirst is always hovering over the party, it must of course be obvious that circumstances will not admit of delay. The weight of water is very great, every gallon of it weighing ten pounds, without allowing for the weight of the water vessels; the amount that can be carried is, therefore, but limited, and it is essential to reach water before the stock of the precious fluid becomes exhausted.

The daily progress of a caravan is but slow, the

* Dr. Barth, *Travels in Northern Africa*, Vol. i, 1857, p. 310.

† *Le Dêsert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, Paris, 1853, p. 617.

§ *Ibid.*, p. 619.

pace of the baggage camel never exceeding 2 to 2½ miles per hour, which cannot be increased without risk of serious injury to the animals; all the authorities agree upon these points, and the animals also require to be watered more frequently than is generally supposed —that is, if they are to be kept in good condition. British military experiences on this point are ample, both in Asia and in Africa, with every sort of camel —and Lord Wolseley's Soldier's Pocket Book tells us that, when worked for three days without water, a camel's condition runs down rapidly, and after long journeys of five or six days without water, it requires several days to regain its strength, while if it is allowed to go down in strength below a certain point, it will take weeks, perhaps months, to pick up again. *

Count D'Escayrac de Lauture appears to have come to substantially the same conclusions, for he states— "that according to the season, camels can go from three to seven days without drinking, and two days without food"— and also that after a trying journey of this kind—"the animal is almost done up and could not start again immediately—it requires some days, and often two or three months to recover; if he is old he will probably never recover, and from that moment has lost nearly the whole of his value." †

The Count then proceeds to cite instances which prove the accuracy of these facts. Shall we therefore conclude that stories of camels passing *weeks* without drinking are mere fabrications of tricky natives to "take a rise" out of the foreigner? or inventions made for the purpose of wilfully deceiving him?

* *The Soldier's Pocket Book for Field Service*, by General Viscount Wolseley, Adj. Gen. to the Forces, 5th Edit., 1886, p. 79.

† *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, Paris, 1853, p. 612.

That by no means follows—as long as the camel can obtain succulent twigs of bushes or grasses, or other nutritious food, water is no longer a necessity.

The examples of the sheep, the rabbit, and the stall-fed ox, which we have already cited, are conclusive in this respect; the two former, as we know, do not as a rule require to drink, when pasturing upon our English meadows, where succulent herbage, dews, and copious showers are plentiful. But in dry hot countries, like South Africa or Australia, sheep require to be regularly watered. So also with the stall-fed ox, if fed on turnips and hay he does not require water, but if he gets hay only he must have water morning and evening. Now in almost all deserts there is a season of life and verdure, however short, provided that there is rain; and it is doubtless by camels when out at grass, at this season, not requiring to be taken to water, that these reports as to the extraordinary time camels can exist without it have arisen.

The watering-places in the deserts of the old world are some of them of very great antiquity. The identical wells, and even the patterns of the water vessels having been handed down unchanged from generation to generation, in the exact form in which they were used, ages ago, by the predecessors of the present race of Arabs. Customs in these regions are as changeless as the aspect of the desert itself, and the habits and mode of life of the nomadic tribes who find a home in these desolate wastes, are probably precisely what they were thousands of years ago. *

Some of the finer and deeper wells of course contain

* See Sir Samuel Baker's *Nile Tributaries of Abyssinia*, 1867, p. 129.

permanent supplies of water of good quality, and of these, many are probably specimens of works descending from the patriarchal times, and even from that of the Egyptian Empire; others are possibly the work of the Carthaginians, or of the Romans—for the desert regions of Northern Africa passed in succession beneath the dominion of each of these powers.

Many notable examples of these ancient wells exist throughout the deserts of Syria and Egypt, and it is stated "that the greater number of the oases of the Libyan chain owe their existence to similar works." * The French engineer Degousée, a high authority in matters of this kind, mentions in his "Guide du Sondeur," that towards the middle of the present century, the Pasha of Egypt undertook a series of works with a view of improving and re-opening some of these ancient wells, "whose original construction probably dated back some four hundred years" and "on the completion of the works it was found that the wells were lined with brick or wood." †

A fine example of an ancient Roman work of this kind is in existence at El Golea, an important city in an oasis in the Algerian Sahara, where "a well of immense size and depth, and well built from top to bottom, furnishes an abundant water supply to the inhabitants. The date of its construction is unknown, but there was evidently a Roman station there." § A splendid example of a great Roman well 400 feet deep is to be seen in

* *Treatise on Well-digging and Boring*, by J. G. Swindell, Architect, and Geo. R. Burnell, C.E., 1854, Ch. I.

† See *Guide du Sondeur ou Traité Théorique et Practique des Sondages*, par Degousée.

§ See *Le Sahara Algérien, Études Géographiques et Historiques*, par M. le Lt.-Col. Daumas, Directeur Central des Affaires Arabes à Alger, Paris, 1845, p. 318.

our own country at Carisbrook Castle in the Isle of Wight, which shows how perfect such Roman works were.

Everyone will also doubtless be familiar with the numerous references, which are made with regard to wells in the Scriptures, which show the importance which was evidently attached to them at this remote period, in what are probably the earliest authentic historical records of the human race.

In many of the pools and shallower wells throughout the desert the quality and quantity of the water depend very much upon the season—one year it will be sweet and good, and the next perhaps it will be brackish, or even of so noxious a quality as to cause disease and death among the animals that have to drink of it; then again some of them become entirely dry during certain years, but the water perhaps reappears the following year.* In the regions where occasional falls of torrential rains occur at uncertain intervals, the watering places often consist of pits, or shallow excavations scratched in the sandy plain, and here and there of pools and other natural reservoirs, some of which are of very considerable extent, but many of these become exhausted during the dry season, while others turn salt and become quite undrinkable, being salter even than the sea.

The whole of the watering places of the desert are, however, far from being known, and there are doubtless many waters which are visited by and known only to the wild animals; and not unfrequently these are discovered by the Arab hunters following the trail of some of these creatures; the fountain will then probably

* See *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, Paris, 1853, p. 67.

be known by the name of the animals, and Count D'Escayrac de Lauture informs us that the desert is dotted over with fountains thus christened, "of the gazelle," "the ostrich," etc.; or named perhaps after some domestic animal as "the camel," "the sheep," "the bull," etc.; in these latter cases the name has very likely been given through the animal wandering away, and its owner after following the trail perhaps for days has at length come up with it, upon the borders of some desert pool, to which the marvellous instinct of these animals had conducted it.*

According to the same authority,

"the water of these pits is in general brackish or putrid: sometimes it proceeds from a soil impregnated by the salts of soda, saltpetre, magnesia or lime, etc.: at other times it has lain long upon the soil, exposed to the scorching sun, and decomposed: the dung of the animals which come to drink adds to the general infection, and the water is green or black, sticky and viscid, its odour repulsive, and the taste acrid or sickly. In the pits it is often bitter, and cruelly purges the unfortunates who are forced to drink it: in the lagoons, its evil smelling properties are still stronger, and act upon the system in the same manner as putrescent substances: it is in one word a regular vegetable septic poison. In general, however, the consequences of its use are not very grave, and only a prolonged usage gives rise to serious consequences." †

The borders of many of these desert pools upon the great caravan routes resemble charnel houses, so thickly surrounded are they with the bones and decaying remains of camels and even of human beings, poor

* See *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, Paris, 1853, p. 600.

† *Ibid.*, p. 600.

slaves who have accompanied the caravans and who, after dragging their wearied limbs to the borders of these fetid waters, have there breathed their last. As an example of the first of these cases we may mention the pool of "El Moorahd," or "the bitter well" in the Nubian Desert, which we have already described, on the route between Korosko and Abou Hammed, another which we may also refer to is the "Fountain of Meschrou," in Fezzan, on the Tibesti caravan route described by the German traveller Dr. Gustav Nachtigal. In the French translation of his work there is an engraving of this desolate and repulsive spot, the mouth of a small well appearing in the midst of the barren sands; two Arabs are seen drawing up water from it by a native water skin, attached to a rope; the sands all round are thickly strewn with the relics of mortality.

"The ground," the Doctor says, "near it, was scattered over with human bones, and the skeletons of camels. I remarked also, not without a shudder, half covered by the sand, the mummified bodies of several children, to which the rags of some Indian blue remains of clothing still adhered. Doubtless these were little negroes, forming part of a slave caravan, who had succumbed to their sufferings during their long desert journey, for it is the custom when they are unable to continue their journey to abandon them, and leave them to perish miserably under the torrid rays of a tropical sun. No tomb shelters these victims of man's barbarity: it is the desert air which is left to slowly mummify them and reduce them to the condition of skeletons."*

The losses sustained by caravans during a long march across wide areas of waterless territory (in South

* *Sahara et Soudan*, by Dr. Gustav Nachtigal, translated from the German by Jules Gourdault, published, Paris, 1881, Vol. i., p. 128.

Africa significantly known as "Thirsts") are often considerable; even under the ordinary risks of the desert carrying trade. The march in such cases has to be continued almost without intermission, night and day, until water has been reached—the fatigues, therefore, which are undergone by both men and animals, are often extreme—animals falling sick or exhausted must, of course, inevitably be abandoned; and human beings must, under similar circumstances, be carried or walk as best they can, until they recover or die.

Fortunately throughout almost all extensive tracts of desert the friendly oases form harbours of refuge, which appear here and there, at certain well-known points, like islands rising out of the ocean. Among the ancients these spots were in fact known as "The Islands of the Blessed." *

Occasionally they are found singly: at other places there are perhaps several which adjoin each other: and sometimes a regular chain of them may be observed, extending at intervals, for considerable distances across the Desert Zone; an examination of a good map of the Sahara, drawn on a large scale, such as that published by the French War Office of the Algerian Sahara and the neighbouring territories, will make this apparent, and shows the immense number of "Wadis" or water courses which extend during the winter rains from the mountains of the "Chaine Saharienne" which lies to the southward of the Algerian "Tell," far into the Desert, until finally they are lost in the sands. A great part of the Sahara consists of a deep depression, now known to be considerably lower than

* μακαρων νῆσοι, see Murray's *Handbook for Egypt*, 8th Edit., p. 17. Also Herodotus, Book iii (Thalia), cap. 26.

the level of the Mediterranean; and the waters descending from the elevated table lands and mountains, doubtless make their way, by subterranean courses through sand and porous strata, overlaid by beds of clay, and other impervious deposits, for great distances, and bursting up at certain points in plenteous fountains there form "Oases."

Of the oases of the Algerian border, that of "*Wargla*" is unquestionably the most important, and deserves a few words of description.

The ancient Arab fortified city of Wargla (or "Ouargla" as the French write it) which claims to be the most ancient city of the desert, † is a place of high historical and strategical importance; situated almost exactly upon the 31st parallel of North Latitude, 199 French leagues from Algiers (= about 482 miles Eng.)

Like many of the important towns of Northern Africa, it is surrounded by an enceinte of immense perimeter; consisting of a crenellated wall, surmounted by no less than forty forts, of two stories each, in terraces; while the walls themselves are protected by a ditch which can be filled with water when desired, and six gates, each opening upon a bridge of masonwork, thrown across the ditch, give access to the surrounding country. § The traveller on approaching the environs of the town, through the desert from the northward, finds an imposing panorama suddenly spread out before him, on attaining the crest of the sterile mountain called Cha'bet-el-Meh'al, which hides Wargla from that side.

† *Le Sahara Algérien*, par M. le Lieut.-Col. Daumas, 1845, p. 75.
§ *Ibid.*, pp. 72, 73.

A forest of date trees extends from the slopes of the hills for some two or three miles across a marshy plain almost to the walls of the town, which is situated nearly in the centre of a forest of these trees interspersed with other fruit trees of almost every sort, while highly cultivated gardens extend in every direction around the walls; the landscape everywhere displaying a scene of fertile beauty which is characteristic of many of the oases. But in consequence of being built upon a marshy subsoil, Wargla is seriously affected by fever of malarial origin, especially during the months of October and May, when the intermittent rains are said to begin and end.*

The climate of the desert itself, as already stated, is generally healthy, but the moment we leave the dry soil and vapourless air of the plains, and enter the fertile oases, malaria immediately manifests itself; thus furnishing a further conclusive proof, were that needful, to show how entirely these diseases are dependent upon the presence of water in some form.

The plague of flies also, which constantly appears concurrently with malaria, here again assails the traveller. Apart, however, from their frequently undoubtedly malarious character, nothing, we are assured by Count D'Escayrac de Lauture,

"can give an idea of the freshness and tranquil beauty of these oases: it is supposed that all these charms are produced by the contrast with the desert; it is, however, scarcely possible that anything could add to them. Beneath the shade of rows of closely planted date trees grow apricots, peaches, pomegranates with beautiful red flowers, orange trees covered with fruit,—henna with little reddish blossoms, and even the apple

* *Le Sahara Algérien*, par M. le Lieut.-Col. Daumas, 1845, p. 73.

tree of our dim climates. Vines also are entwined from one date tree to another; while maize, bending under its heavy cobs, wheat, barley, tobacco, etc., fill all gaps in these admirable gardens, of which the most graceful ornament is still the plume of sombre green which crowns the date trees, and matches itself so admirably to the azure of a sky without a cloud."*

Not an inch of ground susceptible of cultivation is thus wasted, and where the oasis is of small extent the village is usually located upon sterile ground, adjoining its margin, and looking out upon the desert.

At some of the smaller oases the water supply is, however, both scanty and indifferent—and at important points on some of the Trans-Saharian caravan routes, the French government of Algeria has endeavoured to supplement the supply by artificial means; and in a good many instances this has been effected with striking success by means of Artesian wells.

These wells, which are now common in many parts of the world, took their name from the province of Artois, in France, where the first well, on the Artesian principle, was constructed; this practice of boring for water having been adopted there at a very early period: the most ancient of these wells, whose date can be authenticated, being at Lillers in Artois, and supposed to have been executed in 1126.†

The introduction of the Artesian principle by the French government for supplying the oases of the Sahara with water, it is possible, may eventually lead to results of the highest importance, both from a po-

* *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, 1853, pp. 15, 16.

† See *Treatise on Well-digging, Boring*, etc., by J. G. Swindell and G. R. Burnell, C.E., 1854, p. 3.

litical and from a commercial point of view; for it is obvious that if a chain of these wells proved successful in tapping springs, yielding an abundant and permanent supply of water, along one or more of the caravan routes across the Sahara, until the region of the tropical rains is reached; the question of a Trans-Saharian railway will be solved, and everyone not blinded by international jealousies must wish the French God Speed in their attempts to accomplish this great work.

A paragraph in the *Times* headed—"A Natural Reservoir in the Sahara" (dated Paris, April 10th, 1891), records what is probably one of the latest and most valuable instances of the success of French enterprise in this way; and says,

"A large body of water has been discovered at El Golea, in the Sahara Desert, about 120 feet below the surface. It throws up nearly forty gallons a minute, at present, and it is anticipated that the yield will increase. The discovery is regarded as of high importance, as this is the first time water has been found in the Sahara at such a slight depth underground."*

El Golea, which we have already mentioned as an oasis where a good example of a desert well of old Roman workmanship was to be seen, is the site of an ancient Arab town of considerable importance, on the direct caravan route between Algiers and Insalah. It is situated on a rocky mountainous eminence and is mostly constructed in dressed stonework of Roman workmanship, and is better built than any of the other towns of the Sahara.† As a fortress somewhat in

* Reuter's Telegram in London *Times* of April 11th, 1891.

† *Le Grand Désert*, par Eugène Daumas, ex-director des Affaires Arabes à Alger, Paris, 1848, p. 36.

the style of Wargla, it has made its mark in history, and was considered impregnable by the Arabs. El Golea is 101 French leagues, or ten days' caravan march from Insalah,* mostly passing through the sands of the "Sahara-el-Falat" or Waterless desert.

But reverting to the important question of Artesian wells, however, the geological features of the Sahara region, and the low level at which the basin of that great desert lies, render it by no means improbable that the enterprise of a Trans-Saharian railway may be successfully accomplished by their means either wholly or in part; and where the Artesian principle failed, there would still remain the time-honoured plan of the ordinary shaft, from which the water can be raised by pumps; and though the question is somewhat foreign to the general scope of these pages, it may perhaps be well to mention that the principle of the Artesian well consisted of boring down through beds of clay, chalk, or other strata, impervious to water, until a porous bed of gravel, etc., is reached; and if this water-bearing stratum dips, from the point where the water enters until it reaches the place where the spring is tapped, the water will naturally rise in the well, and in some cases where the pressure is considerable, as for instance where it proceeds from a greatly higher level, the water may gush out at the top in a plentiful stream. A good example of this latter result is furnished by the well-known Artesian well at Grenelle, near Paris, sunk by M. Mulot, to a depth of 1802 feet. It was brought to a successful termination in Feb. 1841, after eight years' work, at a cost of about

* *Le Sahara Algérien*, par M. le Lieut.-Col. Daumas, Paris 1845, p. 320.

400,000 francs. The water supplied is about 800,000 gallons a day: it will rise to a height of 122 ft. above the ground, and its temperature is 81° Fahr.* The borings for this well passed through 1378 feet of chalk, the water being found in the green sand beneath. The stories which are so rife in Algeria, (so as to be almost an article of belief with many persons) that small living fish are sometimes thrown up by the fountains issuing from the bore-holes of these wells, are, however, we are assured (on the authority of a French officer, who was engaged in the construction of such wells in the French African possessions), incorrect.

This gentleman, who had ample experience of such matters, informed us during our visit to the Sahara Algerien, that he had never known an instance of living organisms of any kind being thrown out by wells.

A brief notice of the principal Flora and Fauna, and the human inhabitants of the Desert Zone, must bring this section to a close.

First and greatest, among the vegetable productions of this region, stands the Date Palm (*Phoenix Dactylifera*) "The King of the Oasis;" whose head (according to the Arab proverb) is encircled by the fire of heaven, while its feet are bathed in water. According to the German botanist, Thomé (a translation of whose text book is a standard work in our schools), the date palm "is the only tree that has its original, and uncontested home in the Sahara: the rest, as well as a number of other plants, have migrated from elsewhere, or been introduced by man."† Though

* *Treatise on Wells and Well-digging and Boring*, by J. W. Swindell and G. R. Burnell, C.E., 3rd Edit., 1854, p. 82.

† *Text Book of Structural and Physiological Botany*, by Otto W. Thomé and A. W. Bennett, 6th Edit., 1887, p. 443.

by no means disposed to accept the latter part of this theory, we may add that while no sun can be too hot for the date palm, it flourishes only when its roots have access to water; but, as may be seen along the banks of the Nile, these will descend to very great depths until they reach the water-bearing strata, and where the banks have fallen a mass of fibrous roots like cordage are often exposed to view all along this river. Its presence in the landscape, therefore, is a sure sign of water in the subsoil—or else of adjacent wells, from which it is regularly watered.

On the other hand, this wonderful tree is quickly injured by rain. "Like the dromedary, the date palm seems to be but a child of the desert: the desert is its natural abode: and it is there only, when under the influence of its native soil, that it puts forth all its strength and fecundity." *

In the land where rain seldom or never falls and where an incandescent sun daily pours down its fiery beams, out of a sky in which a cloud is rarely seen, the date tree finds its most congenial home; indeed, it is in rainless countries only that the air is dry enough to perfect the fruit in its finest quality. The best dates, for instance, sold in the English market, are known as "Tafilet Dates," grown in an oasis in Southern Morocco, where according to Gerrard Rohlfs, rain seldom falls. †

Among the Arabs the "country of the date tree" is known as the "Belad-el-Djerid," and throughout

* *Exploration Scientifique de L'Algérie*, publiée par ordre du gouvernement par E. Carette, Capitaine de Genie, Paris, 1844, p. 222.

† See Stanford's *Compendium of Geography and Travel for Africa*, edited by Keith Johnston, 2nd Edit., 1889, p. 26.

the oases of that region its culture is the main industry, indeed "this single tree may be said to have peopled the desert, and without it the tribes of the Sahara would cease to be." *

There are said to be over seventy varieties of dates, of which Count D'Escayrac de Lauture enumerates the Arabic names of forty-eight kinds. The geographical limits of the date palm in the northern hemisphere are fixed by the same authority as lying between the 12th and 37th parallels of latitude, † elsewhere it is an exotic. The crest of the full-grown tree attains a height of fifty or more feet; and it is usually propagated by suckers which spring from the roots of old trees and stumps in great numbers, but the date will also grow freely from the stone—but the wild date is the result, and few of the trees produced from seed are worth cultivation—new varieties of value, however, are sometimes thus obtained.

The young trees become fruitful at about eight years of age. These palms flower in March and April, and the date harvest is gathered in October and November; it forms both the principal food and wealth of the desert tribes. The gardens where the date trees grow have, as we have stated, to be constantly watered, to mature the fruit; this is done by a system of small trenches, and banks of earth, formed round each tree, to retain the water and protect its roots. § The dates are produced in bunches of forty or fifty or more like large bunches of grapes. When soft and freshly gathered they

* *Du Spitzberg au Sahara*, par Charles Martins, p. 567.

† *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture Paris, 1853, p. 5.

§ *Ibid.*, p. 7.

are a really delicious fruit and keep well when dried in the sun: they have been put to a variety of uses, even the stones when crushed serving as food for camels. The stones have also been used as a substitute for coffee, and large quantities have of late years been roasted, and sold in England as "Date Coffee," * for the sale of which a company has lately been started in London.

The beauty of the gardens of fruits and flowering plants usually cultivated beneath these trees, has been already alluded to; the dense canopy of dark green plume-like leaves with which the date tree is crowned, prevents the scorching rays of the sun from penetrating in their full intensity to the earth below, so that when rows of these trees are closely planted, as they generally are, the most delicious coolness (comparatively, that is, of course), may, in many of the oases where they form a continuous forest, be enjoyed beneath their shade. The gardens are merely separated by walls of earth, which are pierced with apertures, to admit the transit of water:—in these shady recesses many of our European fruits and vegetables grow and flourish; of the latter turnips, carrots, cabbages, beans, onions, capsicums, tomatoes, pumpkins, gourds, and melons, may be mentioned. †

A description full of dramatic power is given of one of these desert gardens in the sixth sura of the Koran, which undoubtedly forms one of its finest passages, well worthy of insertion here. It runs as follows:

"Verily, it is God that causeth the seed corn, and the date

* Smith's *Dictionary of Economic Plants*, 1882, p. 151.

† Good examples of these Arab gardens are to be seen near Tripoli, which lies on the very edge of the desert, and also near other towns in the French Tunisian possessions along the West coast of the Gulf of Gabes.

stone to bud. He bringeth forth the living from the dead, and He bringeth forth the dead from the living. He causeth the morning to break, and He hath made the night for rest, and the sun and moon for the reckoning of time. This is the arranging of The Mighty and The Wise—and it is He that hath made for you the stars, to direct you thereby, in the darkness by land and sea. It is He who sendeth down rain from Heaven, and we have produced thereby the budding of all things: and from out thereof we have made to spring the green herb, and from it we produce grain: one grain set compact upon another; and palm trees, with clusters of dates hanging from their branches: and gardens of grapes, and olives, and pomegranites, of kinds alike and unlike."*

Then the Scriptures, in one of those highly dramatic word-pictures with which the Book of Job is literally filled, alluding to the ephemeral nature of human existence, as contrasted with this luxuriant springing up of vegetation under the influence of water—out of the apparently dead, parched-up surface of these desert lands, gives the following description of these phenomena,

7 For there is hope of a tree, if it be cut down, that it will sprout again,
And that the tender branch thereof will not cease.
8 Though the root thereof wax old in the earth, and the stock thereof die in the ground.
9 Yet through the scent of water it will bud, and bring forth boughs like a plant.
10 But, man dieth, and wasteth away:
Yea, man giveth up the ghost, and where is he?
11 As waters fail from the sea, and the flood decayeth, and drieth up:

* El Korân Sura vi., p. 96. From "Extracts from the Korân," by Sir Wm. Muir, K.C.S.I., Principal of Edinburgh University, 1888, 2nd Edit., p. 11.

12 So, man lieth down, and riseth not:
Till the heavens be no more they shall not awake,
Nor be raised out of their sleep.*

Among the treasures of the East, which might prove a valuable adjunct to the productions of the Desert Zone, under intelligent management, in some places is the cinnamon tree (*Cinnamonum Zeylanicum*). This tree is of the laurel family and was called the "Cinnamon laurel" by Linnæus, and it is one of those plants which seem to flourish best in pure sand: in the richer soils, the aroma does not seem to develop itself in the same concentrated form. The best cinnamon is obtained from suckers, which spring up (just in the way described in the scriptural narrative), like hazel rods from the stools of old bushes which have been cut down. Mr. P. L. Simmonds, on visiting the cinnamon gardens in Ceylon, states that he was much struck with the curious fact of these trees flourishing in such situations, and says—

"the circumstance impressed me very strongly: it seems so strange to see a plain of pure sand, whitened in the sun, yet covered with a luxuriant growth of trees. These plantations may well suggest a doubt as to the truth of the proposition, that earth, destitute of organic matter, cannot sustain vegetation: certainly it is not organic matter which supports the cinnamon trees of Colombo." †

We can fully confirm Mr. Simmonds' account as to this, from our own personal observations. There are large tracts of cinnamon bush close to the City. The

* Job xiv, verses 7—12 inclusive. [N.B.—Originally this "Book" (as we call it) was written as a poem].

† *The Commercial Products of the Vegetable Kingdom*, by P. L. Simmonds, 1854, pp. 385—6.

cinnamon tree, however, requires to be abundantly watered, especially where the rainfall is scanty, and probably at Colombo the roots reach water-bearing soil into which organic matters have been washed down by the rains.

Beyond the limits of the oases, the vegetation of the desert itself is, of course, always scanty; and over considerable areas, already referred to, as the "Sahara-El-Falat" for instance, it may even be said to become almost extinct—but alternating among stretches of the most sterile character, grassy and even bushy tracts are here and there met with.

The dwarf trees and shrubs found in these bushy portions, are almost always of the acacia and mimosa family, and a good many varieties are covered during the rains with beautiful and deliciously scented flowers, as Pringle, the Poet of South Africa, reminds us, in these charming lines—

> "Bare are the sands, yet smiling there,
> Th' Acacia waves her yellow hair,
> Lovely and sweet, nor loved the less,
> For flowering in the wilderness."*

These dwarf trees are to be seen along the dry beds of torrents, or wherever there is any dampness in the subsoil: they are also apt to collect in dense thorny thickets on precipitous places among hills and other broken ground, especially where the land is scored by dry water courses, and though the presence of water may not be apparent at these places, still it is probable, and indeed practically certain, that these trees are indicative of localities where it would be found,

* Poems by Thomas Pringle. Edited by Leitch Richie, and Publ. London, 1839, 1 vol., 8vo., with a sketch of the Poet's life.

in greater or less quantity, by digging to a comparatively slight depth. The wood of these acacias makes excellent fuel, and some varieties produce a sweet-scented aromatic smoke. The form and appearance of these trees is also always very characteristic, and essentially peculiar to the vegetation of very dry regions,—the shape bearing a close resemblance to that of a mushroom. Solymos, a careful and competent observer of these matters, states that "their tops are as sharp cut as if moulded by gardeners into circular disks, flat and level," and during the surveys for the Soudan Railway he tells us they "rarely accomplish a day's journey without seeing some of them; and that they are as essentially a characteristic and constant trait in the features of even the most barren and rocky parts of the desert, as the rocks, sands and grasses, and appear beautifully suitable to the landscape," * all of them are, of course, exceedingly thorny; thorns, or prickles of some kind, being a characteristic of almost the whole of the vegetation of the Desert Zone, and all dry regions even down to the grasses. Evidently as part of a design of Nature for resisting the action of prolonged droughts, the close bushy twigs and foliage of these trees are therefore specially formed to catch and retain every drop of water that may fall from the sky in the rare event of a shower. The moment that the short rainy reason begins therefore (when there is one), these curious little trees at once burst into verdant leafage. On the conclusion of the rains they revert again almost as quickly to their bare, dry, and apparently lifeless condition. The shoots made during a season's

* *Desert Life*, by B. Solymos, 1880, p. 64.

growth are consequently very short, and this in a measure doubtless accounts for their closely cropped appearance; the necessity for mutual protection against the violence of the sudden storms to which the desert is so liable will also account for their gregarious habit of growth in clumps or thickets. When they grow singly, or on the outskirts of copses and in positions where they are apt to be blown down by storms, another curious feature about these trees is that when uprooted they travel about the desert in an extraordinary manner; being driven about by the force of the wind from one place to another, much as an open umbrella would be, and yet Solymos tells us that under these circumstances they still continue to live on "apparently for years," * thus showing how little these curious trees, when once fully developed, are dependent on the soil for their vitality. When circumstances admit of it, it is more than probable that many of them in the end become embedded in the sands, and taking root again form the nucleus of new plantations at other points.

The rest of the vegetation may be said to consist mainly of herbs, bulbous plants, and grasses; even in the most barren situations, many bulbs full of sap will be found by those who know how and where to seek for them, and occasional tufts of some kind of herbage are rarely entirely absent. Some of these grasses are of an exceedingly valuable character.

The now well-known "Esparto grass" (*Stipa Tenacissima*) of North Africa, known as "*Halfa*" by the Arabs, which has lately been so largely exported

* *Desert Life*, by B. Solymos, 1880, p. 64.—(N.B.—The great probabilities are that though these little trees are much dwarfed, still their age, measured in years, is considerable.)

for paper making, is one of these. It grows in tufts or clumps, in arid and rocky places, and mostly in mountainous localities where little else in the way of vegetation will grow. Its value in the raw state is considerable, and is stated to be from £4 to £6 a ton.

Immediately on the occurrence of rain, most of the desert grasses spring up with wonderful rapidity; quickly producing luxuriant growths of herbage, in all favourable situations, which are much liked by camels and other animals. But as they become desiccated by the severity of the prolonged drought, many of them are apt to become hard and wiry, and the ends of the dried stalks then become converted into an armoury of sharp spikes and barbs; the seeds of a good many varieties are also prickly, and stick to clothes, etc., like burrs; so that travelling at times becomes exceedingly disagreeable. The well-known "Spinifex" or "Porcupine" grass of Australia* may be cited as a good, though possibly extreme instance, of this kind of grasses; it is found growing in large clumps or tussocks, sometimes three or four feet high, which often cover the arid plains for hundreds of miles together." † The wounds inflicted by the spikes of this grass are so serious, that horses "are often lamed, and even killed by it," it is said to be utterly useless as forage, and where these tussocks appear "water is hardly ever to be found." § Another grass of a somewhat similar nature grows extensively in some of the dry karroos

* *Triodia Irritans.*

† Stanford's *Compendium of Geography and Travel for Australia*, Edited by Alfred R. Wallace, 1878, p. 21.

§ *Ibid.*, p. 21, see also *Journal of Colonel Warburton*, the Australian Explorer, pp. 186—7.

of South Africa, the "Poa Spinosa," a desert grass with sharp thorns, and about 1½ feet high—so sharp, that no animal will graze near it, and no barelegged native will venture in among it." * Then of the grasses whose seeds are peculiarly troublesome "Pennisetum Distichum" may be cited as a prominent example, its little burr-like seeds are blown about by the wind, and attach themselves to every article of dress so closely "that small tweezers must be carried to pull them off," † and though it is a valuable forage plant, and the pounded seeds produce a sort of flour much used by the natives, "it is to the traveller his most constant inconvenience." §

Dr. Barth mentions a tall oat-like grass of luxurious growth "AvenaForskallii," and also "Pannicum Grossularium," as among the most valuable of the desert forage grasses, ** the seeds of the latter are, however, also a source of annoyance. Then there is the "Pennisetum Typhoidum" which produces millet, a most valuable grain, much used by all natives in the interior of Africa, †† and during the march of the British expeditionary force across the Bayuda Desert, in January 1885, for the relief of General Gordon at Khartoum, an "almost limitless supply of '*savas*' grass, "the best feeding for camels," was at that time obtainable. §§ In fact, so im-

* *Travels in South Africa*, by William I. Burchell (Botanist and Naturalist) from 1810 to 1812, published 1822, Vol. i.

† Dr. Barth's *Travels in Northern Africa*, published 1857—8, Vol. i., p. 391.

§ *Ibid.*, Vol. i., p. 391.

** *Ibid.*, Vol. i., pp. 254—284, etc.

†† *Ibid.*, Vol. i., p. 391, etc.

§§ *From Korti to Khartoum*, by Col. Sir Charles Wilson, D.A.G. Nile Expedition, 3rd Edition, pp. 9—11. [The botanical name of this grass does not seem to have been noted].

pressed was Sir Charles Wilson, the D.A.G. to the Nile Expedition, with this circumstance, and with the abundance of the water supply at certain points, that he states—"the country between Korti and Matammeh is NOT A DESERT, IN THE TRUE SENSE OF THE TERM,"* yet it is marked as such on all the maps, and numerous travellers report the existence of exceedingly barren deserts considerably to the southward of this point.

This, therefore, may be cited as a good example of the difficulty met with in fixing the southern limits of the Desert Zone in Northern Africa: it is probable, however, that in January 1885 the Bayuda desert was then in a fairly favourable condition as regards vegetation—occasional transitions, according to the seasons, having already been noticed as being common to nearly all deserts.

After a long continued drought, however, all the dwarfer herbage, and less woody fibred grasses, become so dry and brittle, that the sudden storms peculiar to these regions cause them to break off like bits of stick, or tinder; and the débris are then blown away by the wind and finally reduced to powder. Among others, Sir Samuel Baker calls attention to this fact, which came under his notice while travelling in the Nubian Desert, at a point considerably to the southward of the Bayuda region, spoken of by Sir Charles Wilson. † This phenomenon is of so striking a character in dry regions that it has been selected as the Scriptural emblem of mortality.

* See pp. xxvi and xxvii of the Introduction to Sir Charles Wilson's book *From Korti to Khartoum*, A Journal of the Desert March from Korti to Gubat, 3rd Edit., 1886.

† See *The Nile Tributaries of Abyssinia*, by Sir Samuel W. Baker, 1867, p. 61.

Thus, in the numerous allusions to the frailty of human existence which we meet with in the Sacred Writings, we often find the state of man likened to that of the grass of the field; and there can be little doubt that the Psalmist makes direct allusion to this well-known phenomenon of the disappearance of the desert grass, when he says,

"As for man, his days are as grass:
As a flower of the field, so he flourisheth.
For the wind passeth over it, and it is gone;
And the place thereof shall know it no more." *

Most of the scenes of Biblical History are, as we know, laid in lands either within, or else bordering upon, the Desert Zone: and thus we find nearly all the leading natural phenomena treated of in this section, more or less frequently alluded to throughout the Scriptures, in word pictures of exceeding beauty.

Thus the effects of prolonged drought are exactly described by the Psalmist when he says——

"He turneth the rivers into a wilderness, and the water springs into dry ground." †

In every part of the Desert Zone this phenomenon may be observed. Rivers of considerable volume flow into it, but gradually their streams become less and less, until at last they become altogether lost in the sands: and instances are not uncommon where travellers have lost all their cattle, and sometimes their lives, in South Africa, and elsewhere, when attempting to return across dry districts, or "THIRSTS," as they are there called, after the springs have become dry. Then there is a beautiful description given in the Psalms of the awakening

* Psalm ciii., verses 15 and 16.
† Psalm cvii., verse 33.

of Nature out of her long sleep, it may be of many months duration, upon the coming of the rains. It opens with a description of the Greatness of the Creator, of whom it is said——

"Thou art clothed with honour and majesty.
Who coverest thyself with light, as with a garment:
Who stretchest out the heavens like a curtain:
Who layeth the beams of his chambers in the waters:
Who maketh the clouds his chariot:
Who walketh upon the wings of the wind,"*

and then, passing on to the place where the springing up of the vegetation is described, it proceeds——

"He sendeth the springs into the valleys,
Which run among the hills.
They give drink to every beast of the field:
The wild asses quench their thirst.
By them shall the fowls of the heavens have their habitation,
Which sing among the branches.
He watereth the hills from his chambers:
The earth is satisfied with the fruit of thy works.
He causeth the grass to grow for the cattle,
And herb for the service of man:
That he may bring forth food out of the earth.
And wine that maketh glad the heart of man,
And oil to make his face to shine.
And bread which strengtheneth man's heart.
The trees of the Lord are full of sap;
The cedars of Lebanon which he hath planted;
Where the birds make their nests:
As for the stork the fir trees are her house.
The high hills are a refuge for the wild goats;
And the rocks for the conies."†

* Psalm civ., verses 1 (part of), and verses 2 and 3.
† Psalm civ., verses 10 to 18 inclusive.

We shall perhaps be pardoned if we offer a few words of explanation, as to what we conceive to be the precise effect of some of the allusions made use of in this passage.

Next to the camel, there can be no doubt that the ass is the chief representative of the desert beasts of burden, "and is hardly less than the camel a beast of the desert." * The Arab donkeys can go about two days without water and many of the wealthy Arabs are in the habit of riding donkeys, some of them being large and beautiful animals of a pure white colour, with very good action and easy motion: a great improvement on the camel where very long marches are not required. The wild ass is also specially a denizen, with certain species of gazelles, of some of the most barren deserts in the world, both in Asia and in Africa, and we believe we are justified in saying that it is found, in its wild state, only in such situations.

In the Book of Job, for instance, the wild ass is referred to in the following terms—

"Who hath sent out the wild ass free?
Or who hath loosed the bounds of the wild ass?
Whose home I have made the wilderness,
And the barren land his dwellings.
He scorneth the multitude of the city,
Neither regardeth he the crying of the driver.
The range of the mountains is his pasture,
And he searcheth after every green thing." §

As regards the passage "He watereth the hills from his chambers"—it evidently refers to the ancient

* See *Arabia Deserta*, by Charles M. Doughty, 1882, Vol. i., pp. 281 and 428.

§ Job xxxix., verses 5 to 8 inclusive.

Hebrew belief as to the existence of great reservoirs of water in the upper heavens, from whence the rains were supposed to have their sources. This matter has been gone into in some detail in connection with the question of the Rains in the chapter on Climates and Temperatures to which we beg to refer the reader.

The Vine has been specially mentioned by the French traveller Count D'Escayrac de Lauture, as one of the plants cultivated in the oases beneath the shade of the date tree, and though it may only be used there as a fruit, the best wines, as we know, are all products of dry, stony and barren districts; nevertheless some of the wines of Egypt were renowned for their excellence at a very early period. But though wine from the juice of the grape is not now made in Egypt, palm wine is very largely used in all regions where the palm tree grows, where the freshly drawn sap forms a refreshing beverage; if, however, the liquor is allowed to stand and ferment it becomes exceedingly heady and intoxicating. It is consequently a disputed point among Mohammedans as to whether palm wine is forbidden by the Korân or not—some of the less strict hold, that as it is a *natural* product, and not a manufactured one, that it is not forbidden by the Prophet. Thus they say of the Christian "they drink '*the fermented*' which is forbidden to the Moslemîn."*

As regards the reference to "oil to make his face to shine"—oil, or fat of some kind, is still used by nearly all the African tribes and oriental races as a lubricant, partly because it improves their appearance,

* See a passage in *Arabia Deserta*, by Chas. M. Doughty, 1882 to 1888, Vol. ii., p. 87.

and partly as a protection against the scorching power of the sun's rays.

"The trees of the Lord are full of sap"—we are inclined to think that this has reference to the drawing off of sap to which we have already referred, when mentioning the matter of palm wine. Certain sorts of palm trees will give off several quarts of sap daily, for some weeks together—and the quantity of sap or fluid contained in many of the desert plants is well known to be altogether phenomenal.

"As for the stork, the fir trees are her house"—though the fir tree is not a habitant of the Desert Zone, certain sorts may perhaps be occasionally seen as exotics—but there are other trees whose foliage are exceedingly like that of the fir tree. We need go no further to seek for an illustration than to mention the tamarisk (*Tamarix Gallica* [*Linn.*]). This tree is very common in Egypt, and the new-comer might easily suppose it to be a species of fir—in colour it resembles the Weymouth Pine (*Pinus Strobus*). It is to a tree of this species to which we conceive reference may here be made. The stork is seen everywhere in these countries: and immense flights of them may be seen at certain seasons both in Upper Egypt and Nubia.

The wild goat which is still found in the mountains between the Nile and the Red Sea * is well known to be an inhabitant of the loftiest and most precipitous mountains, and rarely or never descends to the plains. The goat in its domestic state also everywhere accompanies the desert nomads in their journeyings;—by

* See Murray's *Handbook for Egypt*, 8th Edit., 1891, p. 26.

"conies" we conceive that the desert hare with sand coloured fur is intended to be indicated—the rabbit in its wild state is a denizen of the temperate lands, and we can find no mention of it in the works of travellers in connection with the Desert Zone—but the hare is found in almost all deserts, and is often started from her form by the feet of the passing caravan. *

It is not, however, to be supposed that this passage from the 104th Psalm refers to countries in the Desert Zone only, as there is much fertile territory in Palestine, the whole of which is subject to long-continued droughts of exceeding severity; the famines occasioned by them are often referred to in Scripture; and the country is on these occasions more or less completely reduced to the condition of a desert until the return of the rains.

The fauna of the Desert Zone is, of course, like the vegetation, restricted to a comparatively small number of species. During the short season of fertility, it is probably visited by many descriptions of game, but it would not be correct on that account to number them among the regular habitants of the desert. The number of species of birds and animals which have been noticed as occasional visitors is, however, very large—but as the waters dry up and the vegetation begins to wither, these take their departure in common with the desert nomads and their flocks; of whom a regular exodus then begins, of which descriptions have been given by Baker and other travellers.

In addition to the animals we have already mentioned, the gazelle (*Arabice* El Ghazal) is the only

* See *Travels in Arabia Deserta*, by Chas. M. Doughty, 1882—88, Vol. i., pp. 305 and 326, etc.

regular habitant of the desert which we think ought not to be passed over without a few words of special notice.

The reports of travellers seem to show that there is literally no desert too sterile for these beautiful and delicately formed animals to find subsistence there. Like almost all the denizens of the desert they have been coloured by Nature so as to match more or less exactly the colour of the sand—and of this protective colouring the gazelle furnishes a conspicuous and very beautiful example: so closely do their coats resemble the general colouring of the landscape that in the distance, and when at rest, it is scarcely possible to distinguish them from the surrounding sand and stones.

In some of the more barren districts in which these animals find a home, the only herbage that seems to be produced is confined to occasional tufts of wiry grass, and a few dwarf and strongly scented aromatic herbs. Many of the desert herbs partake of this fragrant nature, and when crushed beneath the foot, or in the fingers, emit a delicious and powerful fragrance.

Dr. Barth, the German traveller, mentions that in some parts of Northern Africa, the dung of the gazelle becomes so strongly impregnated by this aromatic scent, that it is collected by the Arabs, and when perfectly dry it is reduced to powder, and used as a species of pungent snuff. According to Mr. Doughty, the number of these animals that frequent some parts of the Arabian deserts is extraordinary and vast herds of them have occasionally been met with by the great Hadj Caravan; * the gazelle, he also thinks, is identical

* *Arabia Deserta*, by Chas. M. Doughty, 1882—88, Vol. i., p. 50.

with the roe deer of the Scriptures. Nature seems also to have endowed these beautiful creatures (whose only protection against their numerous enemies is their fleetness and protective colouring) with the remarkable faculty possessed by the hare and a few other animals, of changing their colouring according to the prevailing tints of the landscape.

These changes of colour, as in the case of the hare, are of course the work of time; but Mr. Doughty has noticed that they are mainly white upon the great sand plains, whereas their prevalent tint is a dark grey upon the black "*Harra*" or lava fields of the volcanic districts,* where the rock is of a still darker hue, they continue to adapt themselves to its sombre colouring, for he tells us "a startled troop of gazelles scudded before us; here they "are robust, and nearly of the colour of basalt."† The fawns are occasionally captured when very young and reared by the nomads—but so hardy and fleet are these little creatures that when but a few days old they will outrun the greyhounds or hunting dogs of the Arabs. These gazelles make beautiful pets, but are very destructive in European houses, tearing and eating hangings and furniture of all sorts. Speaking of the beauty of these desert loving animals, Sir Samuel Baker says,

"A buck gazelle weighs from 60 to 70 lbs., and is the perfection of muscular development. No person who has seen gazelles in confinement, in a temperate climate, can form an idea of the beauty of the animal in its native deserts. Born in the scorching sun, nursed in the burning sand of the

* *Arabia Deserta*, by Chas. M. Doughty, 1882–88, Vol. i., p. 328.
† *Ibid.*, Vol. i., p. 395.

treeless and shadowless wilderness the gazelle is among the antelope tribe, as the Arab horse is, the high bred and superlative beauty of the race. The skin is sleek as satin, of a colour difficult to describe, varying between the lightest mauve and yellowish brown, the belly is snow white and the eye is perfection, full, large, soft, and jet black." *

To have an eye like the gazelle (*Arabice*—Ain-El-Ghazal) is an expression, as we know, constantly made use of to denote the highest type of female beauty; and this rather long, almond shaped, dark eye, has been laid claim to as a speciality belonging to the beauties of the East. The splendour of the dark eyes of one of these nymphs have been thus dramatically described, in a legend, related by an Arab story-teller, "She had eyes large and soft as the gazelle. There were none that could compare unto them; and they were dark as the night that is without moon and without stars. And though she depart and is removed afar from me, still her abode will be in my heart, and in the recesses of my bosom: and as for her presence, it is as the sun shining high in a cloudless sky." †

There can be little doubt that allusion is here made to the lustrous beauty of the eye of the "*Gazella Dorcas*," a small antelope which is common throughout the deserts of Arabia and Northern Africa; where it is sometimes seen in large herds. The word "Dorcas" itself is identical with the Greek "δορκάς," which we are told on the authority of Calmet, a learned French

* *The Nile Tributaries of Abyssinia*, by Sir Samuel W. Baker, 1867, pp. 47—8.

† Part of an Arab tale.

theological writer, primarily signifies "Beauty," and is so translated in several passages. But a reference to the Lexicon shows that among the ancient Greeks "δορκάς" was also the name of an antelope celebrated for its beautiful eyes, and which has been described by Aristotle as the smallest of the horned animals. *

In our own language, the word is still retained as a female Christian name, and has also been adopted as the title of charitable associations for the supply of clothing to the poor. These societies, as is well known, are so called after the Israelitish lady *Tabitha*, "which is by interpretation Dorcas," † mentioned in Scripture as residing at Joppa, and making garments for the poor—and Calmet in his History of the Bible, thinks her name may have been derived from the fact of her having fine eyes, of the gazelle type of which we have spoken, the word Tabitha being the Syriac for a gazelle. § This peculiar form of eye appears in an exaggerated form in the Chinese and Mongolian races; whereas among the Caucassian, or western European nations, the rounder type prevails—such as we are accustomed to at home; in China, however, they are termed "Devil's Eyes," so great was the astonishment which their unwonted appearance produced among the lower orders of that most most ancient and remarkable community.

Like the animals, the numbers of birds seen in the desert are few, and the variety of species among its

* *Κερατοφόρον δε μικρόν πάμπᾶν ούδὲν ἴσμεν ἐλάχιστον γαρ ἐστι τῶν γνωριζομενων δορκάς* (Aristotle,—P.A.—Book iii—ii—7).

† See *Acts* ix., 36.

§ See *Webster's Dictionary*, 1874. Appendix—"List of English names of Women."

regular habitants inconsiderable. In these dreary solitudes the voice of the bird is but rarely to be heard breaking in upon the deathlike silence which reigns almost uninterruptedly; and in common with the rest of the living creatures, the desert birds are almost always coloured so as to match the sands in the midst of which they live. A few sand-grouse, doves, and small pigeons may be said to comprise the list of game birds, and these are said to be tough, dry and indegestible eating. It is in the great dry plains of the Bush Region, on the equatorial margin of the Desert Zone, rather than in the desert itself, that these birds may occasionally be seen frequenting the water pools in the dry season, in almost incredible numbers, in the evenings and early mornings.

In popular opinion it is, however, always supposed that the ostrich is at once the greatest and most prominent representative of bird life in great deserts, and in most parts of the Arabian and African deserts these birds may be occasionally seen—rather, however, we venture to think, as visitors than as regular inhabitants. The ostrich, it is well known, is of a very migratory nature, and wanders over an immense extent of country—wherever, in fact, extensive dry plains are to be found, but these curious birds are more generally seen inhabiting the great game country rather than the desert itself, and they seem to like the company of other game animals, such as antelopes and zebras, in preference to the absolute solitude of the perfectly sterile waste.

Among the ancients the ostrich was looked upon rather as a kind of animal than a bird, doubtless from the circumstance that it never used its wings for flight,

but depended upon its swiftness in running to escape from the attacks of enemies: and as its name "Struthio Camelus" denotes, it was generally regarded as a species of camel. Indeed, a camel standing among bushes in the distance often looks exceedingly like a gigantic ostrich. The peculiar habits, and apparent neglect of its nest and young, together with the extraordinary swiftness of foot displayed by the ostrich when pursued by horsemen, are all found faithfully described in the Bible in the following passage:—

"Gavest thou the goodly wings unto the peacocks, or the wings and feathers unto the ostrich which leaveth her eggs in the earth, and warmeth them in the dust, and forgetteth that the foot may crush them, or that the wild beast may break them. She is hardened against her young ones, as though they were not hers: her labour is in vain without fear. Because God hath deprived her of wisdom, neither hath He imparted to her understanding. What time she lifteth herself on high, she scorneth the horse and his rider."*

The rearing of these great birds, in a domestic state, like cattle, for the production of ostrich plumes, has of late become quite an extensive branch of industry, and their nature and habits are fully described in books on ostrich farming. The industry has, however, been somewhat overdone recently, so that the profits of the business have become rather precarious.

The ostrich, however, in its wild state still roams over an immense extent of wild country; and though like other kinds of great game they are gradually being drawn further and further into the heart of the

* Job xxxix., verses 13 to 18 inclusive.

wilderness, many years will elapse ere this noble bird will have to be struck off the game list of the Desert Zone and the adjoining territories. The habits of the ostrich and her mode of making her nest are beautifully portrayed by Thomas Pringle, the Poet of South Africa, in his poem "Afar in the Desert," a copy of which is annexed to Chapter XIV in this work.

We shall close this section with a brief notice of the interesting race of nomads whose home is in the great deserts. Without some such notice of man as he exists amid some of the wildest and most desolate regions of the Earth, we can hardly think that any description of the Desert Zone could be deemed complete.

It has often been remarked that the Bedouin Arabs in the eastern, and the Red Indians of America in the western hemisphere have many qualities in common: both of them inheriting the same noble and warlike characters, which make them the finest natural soldiers in the world:—the same intense love of freedom, the same unconquerable attachment to a wild life, burn in the breasts of both. Born amidst the wastes and solitudes of Nature, as the tenants of the wilderness they live, and move, and have their being; and as such they will live in story. The red man, however, has always remained the crafty, ferocious, untameable savage. But for ages the Arab has been endowed with a certain rude polish, which has made him, as it were, one of Nature's gentlemen—proud, dignified, courteous, and self-possessed. Even the poorest of the desert nomads receives a stranger with an air of one accustomed to the society of the great; whilst in face, form, and dress, their appearance is for

the most part always both picturesque and striking to a high degree.

There can be no doubt that the gracefully flowing robes of their Eastern costume contribute not a little to heighten these impressions; nevertheless it is by no means uncommon to see faces with bronzed and weather-beaten lineaments exhibiting some of the finest examples of manly beauty which can be seen in any part of the world: and so far as our experience goes, these grand types of aristocratic countenances (presenting the appearance of beautifully chiselled statues, cast in bronze, from Nature's finest mould) are much more often to be seen among the desert nomads than amongst the inhabitants of the towns.

We have, in common with almost all travellers in the East been frequently struck by the dignified and patriarchal appearance of some of these men, whose whole worldly possessions very likely consisted of the tattered garments upon their backs, and perhaps the horse, or camel they bestrode. Such examples must be numerous in the recollections of all tourists who now annually visit the Nile regions in such astonishing numbers; and the European visiting Egypt, while viewing the innumerable monuments of an immense antiquity with which he is surrounded, will doubtless call to mind many scenes which he has witnessed, exactly similar to that so graphically described by Byron in the following lines:—

"There was a mass of many images
Crowded like waves upon me, but he was
A part of all; and in the last he lay
Reposing from the noontide sultriness
Crouch'd among fallen columns, in the shade

Of ruin'd walls, that had survived the names
Of those who reared them; by his sleeping side
Stood camels grazing, and some goodly steeds
Were fastened near a fountain; and a man,
Clad in flowing garb, did watch the while,
While many of his tribe slumbered around,
And they were canopied by the blue sky,
So cloudless, clear, and beautiful,
That God alone was to be seen in Heaven."*

Such are the Arabs of to-day—and as such they are known to have existed practically unchanged in habits, customs, dress, or appearance since the time of Abraham—and of most of them it may still be said, as it was said of the patriarchs of 3000 years ago, that the stranger was always certain of welcome at his tent, where he is regarded as "the guest of Allah." Hospitality, therefore, in its largest sense, has always been looked upon as a species of religious duty among the Arabs, who in morals, habits, and religion, may be considered the Puritans of the desert. As among the Puritans, the name of God is constantly on their lips, and religion is mixed up with almost every act of their daily life.

All of them, we need hardly say, are Mohammedans of the strictest sort. It would, however, be foreign to the purpose of this work to enter into a detailed description of Arab life—we shall therefore confine our observations to a few extracts from works of authority on such subjects, with a view to illustrate its most striking features as briefly as possible.

The following is a translation of some portions of a set of verses made by a Marabout (a species of

* *The Dream*—Lord Byron, part iv., lines 8 to 21.

"Saint" or travelling fanatic)—descriptive of Bedouin life in the Sahara :—

"The wandering Arab is encamped in a vast plain,
Around him nothing breaks in upon the silence
By day, but the lowing (or moaning) of camels:
By night, but the cry of jackals, and of the Angel of death.
. . . . . .
The sun is the hearth before which I warm myself
The clear light of the moon is my torch.
The herbs of the earth are my riches.
The milk of my camels is my sustenance.
The wool of my sheep is my vesture
I lie down where the night overtakes me
My house cannot fall to pieces.
. . . . . .
I am the bird of migratory habits.
He carries with him no provision
He does not sow, He does not gather in (harvest)
God it is that provideth his sustenance."*

It would be difficult to convey a better idea of Bedouin life than is portrayed in these lines, recited by one of themselves.

Their strict views respecting the duties of a host towards his guest and the self-command which is part of the Arab character are admirably illustrated in the following anecdote. The incident occurred in the Sahara Desert, during the stay of a caravan at an Arab town in one of the oases——

"Our host's son, a little boy of seven or eight years of age, had delighted us with his grace and vivacity. His father adored him. In the evening, however, he did not come to supper, and we asked his father to send for him.

* *Le Grand Désert, ou Itinéraire d'une caravane de Sahara au pays des Nigres*, par Eugène Daumas (French general), Paris 1848, p. 373.

'He sleeps a profound sleep,' he replied; we did not therefore insist further. The repast (which followed) was abundant, and the conversation most animated, and the Christians and the War were much discussed.

Next day the father said, 'When I told you yesterday evening that my son slept profoundly, he had just been killed by falling from the top of the wall, where he was playing with his mother. It was the will of God, who has given him rest. So as not to mar your feasting and your joy, I concealed my grief. I made my afflicted wife keep silence, and her cries did not reach you. But this morning be good enough to attend my son's interment, and join your prayers for him, to mine.' This news, and this strength of character overcame us, and we went piously to bury the poor child. Such is the law of hospitality! a host is bound to put away from his house all griefs, all quarrels,—everything that can trouble his friends' stay. For the Prophet has said, 'To him who shall be generous, God shall give twenty graces. Be generous, therefore, to your guest, for he brings to you his benefits:—in entering he brings a benediction—in departing he carries away your sins.'"*

"Speed the stranger on his way to his own people" has thus always been a maxim among the Bedouin tribes, and indeed among the whole of the Mohammedan races, for—"Be we not all" (say the poor nomads) "guests of Allah"—"Has God given unto them: God's guest shall partake with them thereof: if they will not render unto God His own, it should not go well with them." †

It is, perhaps, almost superfluous to add that the teachings of the Holy Scriptures, are in no wise less

* *Le Grand Désert*, par Eugène Daumas (French general), 1848, pp. 41 to 43.

† *Arabia Deserta*, by Chas. M. Doughty, 1882—88, Vol. i., p. 228.

emphatic than those of the Korân, in inculcating the duties of charity and hospitality, and the remarkable words of the great Apostle St. Paul will doubtless be familiar to many, where he reminds the followers of Christianity to "Let brotherly love continue." "Be not forgetful to entertain strangers: for thereby some have entertained angels unawares." *

In the days of old, as history teaches us, the custom of entertaining the passing traveller was almost universal, and at sunset, the wayfarer could knock without scruple at the nearest door, confident that a night's food and lodging would not be denied him.

But this was before the days of hotels and poor laws—and as we travel further back into the times of antiquity, we shall not fail to discover that the well-to-do, and wealthy householder of those days, not unfrequently prided himself upon the largeness of his hospitality, which was gratuitously extended alike both to the rich and to the poor.

The advance of civilization, however, has changed all this, and the traveller will occasionally experience its advantages by observing the exorbitance of the charges now sometimes exacted by those of "advanced" opinions even among the Arabs for trifling services. Among the desert nomads, however, a good deal of the open-handed liberality descended from the patriarchal times, nevertheless still survives these blessings; and, as a rule immediately upon the stranger's arrival, even if only for a short halt, a cup of sweet coffee is offered, if there is any; or otherwise a draught of milk, generally in a curdled state. This to European palates is often at first distasteful. Nevertheless after

* *Hebrews* xiii., verses 1 and 2.

a time, its somewhat acrid flavour becomes appreciated, as exceedingly refreshing after a hot sun. But to proceed.—The romantic aspects of Arab character and its religious cast of thought are well illustrated in the following legend, of which the translation has been somewhat abbreviated for insertion here, but the leading features of the story have all been carefully preserved.

THE TEMPTATION OF SIDI AOMAR.

"Sidi Aomar was a man who feared God—good, hospitable, very humble, and holding in contempt the good things of this world. The Divine blessing was over him, and the demon could not prevail against him.

(Here it is related how, for the purpose of trying his faith, he was delivered to the temptation of Satan, who asserted that he was only a hypocrite)—and—

"Sidi Aomar went as usual to the well to make his ablutions, before prayers, and when he drew up the water jar, it was filled to the brim with silver. 'It is not silver that I ask for,' he cried, 'but only water for ablution,' and after emptying the water vessel upon the sand, he let it down again into the well. This time he brought it up full of gold. He threw out the gold upon the earth, upon the silver. The third time it came up full of precious stones.

"'Must I then,' cried the holy man, 'do my ablutions with the sand of the desert, like the pilgrim on his travels?' Having made this invocation with his face turned towards heaven, when he cast his eyes down again to the earth, he found the heap of silver, and gold, and precious stones had melted into limpid water, which ran down the slope, and it has never since

ceased to flow: it is known as '*Ain-El-Foukara*' or the 'Fountain of the Poor.' 'God is great,' cried Sidi Aomar, as he threw himself upon the earth where the miraculous spring issued, and thrust his hands into it, and made his ablutions. As he regained his house reciting his devotions, he saw afar off, two girls of the Soudan, sitting before his doors, and an unknown negro held a horse, magnificently caparisoned, by the bridle, seeming to await his coming. 'What Sultan has come to visit me, the poor hermit?' asked Sidi Aomar of himself; and he hastened forward so as not to keep his guests waiting.

"But the negro bowing down to the ground said, 'The Sultan of Fess hearing of thy virtues, and thy poverty, hath sent thee great riches, and I myself am thy slave.' 'I have no need of slaves,' replied the marabout, 'return whence thou camest. Take back to the Sultan his present, and say, that by the Grace of God, I have enough.' At this moment the sun arose: there was a great cry; the young girls, the negro, and the horse all vanished; leaving no trace behind them.

"Then Sidi Aomar knew that the hand of God was upon him, and that he had been preserved from the arts of the demon."*

The character here assigned to Sidi Aomar is that of a local saint, Fakir, or Marabout, such as is common among the nations of the east, and the miraculous fountain of "Ain Foukara" means in the Arabic "The Fountain of the Fakirs." "Foukara" or "Fokara" being the plural of "Fakir" "poor"—that is, poor, or humble, in a religious sense. A Fakir being supposed to be "one

* *Le Grand Désert*, par Eugène Daumas (French general), Paris, 1848, pp. 89—92.

who has chosen poverty for himself to come closer to God"—thus many pious Moslems end their letters, the humble, or poor one, before God. *

The "Sheikh El Islam," for instance, in his official proclamations, interpreting disputed points of Mahomedan theology, signs himself "The Humble—so and so—Sheikh El Islam."

It would be foreign to the purpose of this work to enter at any length into questions of Moslem Theology, yet it may be well just to mention that the followers of Islam are composed of an infinite number of religious sects, or orders, and it is probable that Sidi Aomar, judging from the title of "Sidi" or "Sir" prefixed to his name, would represent the Sheikh † of one of these fraternities, for it is stated in the narrative that people flocked from great distances to make what is known as a "*Ziara*" or "pious visit" to the place of his abode. Of these pilgrimages that of the "*Hadj*" to the tomb of The Prophet, at Mecca, is of course the first and greatest—but other and minor pilgrimages, or *Ziaras* to the tombs of saints, etc., are also esteemed highly meritorious, in a religious sense: and those who have travelled in Mohammedan countries, will doubtless have noticed the numbers of these sort of tombs, erected over the places of sepulture of Sheikhs of religious orders. Many of these shrines are held in great veneration, and the spiritual influence of their tenants is by no means regarded as extinguished by death, but rather the reverse; prayers offered up by the devout at such

* *Marabouts et Chouans*, étude sur L'Islam en Algérie, par Louis Rinn, Chef du Service des affaires Indigènes au gouvernement, p. 66.

† *Sheikh*, literally "an Elder," from the Arabic "Shakka" to be old—in other words "*a chief*" or any man of eminence.

spots being regarded as peculiarly efficacious:—Nor are these shrines without their practical utility among the wild tribes of the east—for instance, when an Arab conceives himself to have been wronged by a neighbour, instead of threatening "to put the matter into the hands of his solicitor" as people do in Europe, if his adversary persists in refusing justice, and he feels that he is the weaker party and unable to enforce his claim, he forthwith makes one of these *Ziaras* to the grave of the local Sheikh: there he erects a small pile of stones: he places these one upon another upon the grave, as an offering or memorial, testifying to the wrong that has been done to him. The injured man then seeks another interview with his adversary, and again urges him to grant redress, and tells him of his visit to the tomb. But if justice is still denied, the interview ends by his saying that "it is well," "and that he leaves his cause in the hands of Allah," for in the Korân "the perspicuous Book," "the Book which cannot be doubted," it is written that the just alone shall prosper.

We are not aware that this custom is universal, but there can be no doubt that it is common among many of the wilder tribes, and it is said to be rare to find anyone who ventures to disregard such an appeal. If the wrongdoer knows that the injured party has right upon his side therefore, he generally ends by giving in —"lest some evil should befall him"—and hands over the money, or whatever it is, that was in dispute—and in this way a rude but substantial justice is often obtained.

We cannot, of course, be blind to the many faults of the Arab character, such as their oftentimes grasping and

covetous natures—the grievous oppressions and misdeeds of their native rulers:—the continual wars and inter-tribal dissensions over their respective "dira" or boundaries of their desert territories, and consequent commotions and blood-feuds—yet though the Arab disposition is generally regarded as revengeful and merciless, the following anecdote shows that a certain noble generosity and forgetfulness of injuries is by no means unknown. Under the Mohammedan law of the Arabs, it is usual when persons are convicted of murder to deliver up the criminal to the vengeance of the next of kin. Mr. Doughty relates an instance at Anegza in Arabia, where a woman enticed a little girl, the only daughter of a wealthy family, into her yard, and there foully murdered her for the golden ornaments which she wore, after which she buried the body near her house. The remains were, however, discovered, under circumstances which left no room for doubt as to who had committed the crime, and the criminal was brought forth to suffer death in the presence of the assembled people by order of the executive Emir. For fifteen years we are told, there had been but one previous capital punishment in this town. The woman was now delivered bound to the kindred of the slain, to be put to death—and Mr. Doughty gives the following account of what followed. The Emir "bade the father 'Rise up and slay that wicked woman, the murderess of his child.' But he, who was a religious elder, and a mild and godly person, responded—'My little daughter is gone to the mercy of Allah; although I slay the woman, yet may not this bring again the life of my child. Suffer, Sir, that I spare her; she that is gone, is gone.' 'But,'

(replied the Emir) 'her crime cannot remain unpunished, for that were of too perilous example in the town. Strike thou, I say, and kill her.' Then the father drew his sword, and slew her, according to the order of the Emir."*

Mr. Doughty, who passed some years in travelling through Arabia, among some of the wildest and most fanatical tribes in existence, speaks in high terms of their hospitality and honesty. His attempt to visit them was generally accounted an act almost of suicide, for it was considered certain that he would be robbed and murdered by them; yet though his life was often threatened on the grounds of his being a Christian, he was very seldom seriously molested; for on these occasions, there were always plenty of respectable people ready to take his part, and afford him shelter and protection as "the guest of Allah."

This chapter has been prolonged beyond its intended limits, but special attention has been bestowed upon the Desert Zone because the phenomena of the desert have been but too often passed over in works of travel, as if they were hardly of sufficient interest to deserve attention—and yet the desert is everywhere replete with both interest and instruction. Its scenery, for instance, is often grand in the extreme: for the artist, the matchless colouring of its landscapes can hardly be surpassed: as we have endeavoured to point out, it is a great mistake to suppose that it consists merely of a flat and dreary waste of yellow sand; nothing could well be further from the truth; take, as an instance in point, the section of sterile desert within easy reach of every tourist, passed through by the Suez

* *Arabia Deserta*, by Chas. M. Doughty, 1882—88, Vol. iii., p. 368.

Canal, and notably that portion traversed by the railway from Ismailia to Suez: given a day when the sun is shining brightly, the sands, gravels, and sterile cliffs and mountains comprise almost every shade of colouring, from white, to deep reds, and yellows, and even chocolate, and purple hues: but the splendour which the stern lineaments of the desert can assume are never more striking than at sunset and sunrise: let any lover of the beauties of Nature take the trouble to watch the effects produced at these times, either at Suez, or along the Nile, or from the plateau of the great pyramids at Gizeh looking eastwards towards Cairo, with its white houses, numerous minarets, and ancient citadel seen across the valley of the great river clothed during the tourist season in its matchless mantle of emerald green. But it is not these things, beautiful as they certainly are, which produce the marvellous effects of colouring to which we desire to call attention —these are merely adjuncts, such as the skilful artist might desire to make use of, to set off the principal feature of his picture.

It is the desert itself which occupies the leading place in the picture. The distant hills, which almost everywhere form the background in the great panorama, generally appear perfectly divested of every particle of vegetable covering; mere masses of sterile rock. The country appears bereft of every trace of life, yet on cloudless evenings, as the sun is setting, the landscape will be seen lit up with a glowing mantle of deep rose pink which cannot fail to strike every beholder with wonder and admiration.

The scenery of the desert is, in fact, on these occasions, very often grand and impressive, beyond

description. Nor is the change less remarkable when the sun has actually set. We shall never forget, for instance, the effects produced by a sunset upon the Nubian Desert. The sun was at the time just sinking below the horizon: the whole landscape appeared a mass of fiery red—but just then some incident occurred to call away our attention for a few moments. We can hardly think even five minutes had elapsed before we again returned to admire its splendours. But it was gone! During that brief interval the sun had set—and a cold grey stony hue had replaced the deep warm tints of rose—just as if the hand of death had been suddenly stretched forth over the fairy scene.

But the majesty and beauty of the desert nights, matchless in their untroubled serenity are, if possible, most striking of all. The works of travellers in such regions are filled with pictures descriptive of these delicious periods of beneficent rest and peace. Even by day, as the late Dr. Junker has observed, when speaking of the scenery of the Libyan Desert,

"At the solemn majesty of the wilderness every sound is hushed—more vividly even than the sea the solitude produces the impression of limitless space, its very grandeur stimulating to reverie, and awakening feelings of awe and devotion. But the predominant sentiment produced by a journey in the desert is one of quiet serenity. The desert air, as remarked by Bayard Taylor, is an elixir of life, pure and refreshing. The swarthy nomads love their desert home: their dark eye sparkles as they sing its praises, and for hours together their song is poured forth, animating the monotony of the camels' step, as it rises and falls in uniform cadence. The night song is specially impressive, when the wilderness glitters in the white moonlight as if mantled in snow: when distances seem vaster, the camel's shadow larger, and the

stillness more intense, broken only by the crunching of the sand beneath the animals' feet." *

Count D'Escayrac de Lauture speaks much to the same effect, so does Dr. Hans Meyer—the desert according to the latter in its deathlike stillness suggests the idea of Infinity, and far more than the ocean, leads the mind to the contemplation of things sublime. *

It is commonly supposed that a journey through a desert is of necessity an affair involving tremendous fatigues, and exposure to pitiless glare and heat, such as to render all enjoyment impossible. That is as may be. When a caravan is obliged to cross very extensive waterless tracts, of course it must continue the march almost night and day, whatever the condition of the travellers, as the safety of all depends upon reaching water within a given time, but at other places springs exist all along the route at convenient distances: and experience shows that this class of travelling is quite capable of being so managed as to be very enjoyable, and often exercises what seems to be an irresistible charm over many minds. As regards its loneliness, Solymos affirms that—"not a tenth do people in the desert feel the solitariness of an average bachelor in town." † We shall close our remarks on this head by appending a translation of the last paragraph of the work of Count D'Escayrac de Lauture, a high authority in these matters, to which reference has so often been made. He says—

"What renders travelling in the desert comfortable is the

* *Travels in Africa*, by Dr. Wilhelm Junker, translated from the German, pp. 41 and 42.

† See Dr. Hans Meyer's *Across East African Glaciers*, translated from the German, p. 74.

§ *Desert Life*, by B. Solymos, 1880, p. 34.

facility with which one can carry all that one wants, on camels.* One travels, so to speak, with one's household—one has large and good tents, bed, easy chairs, cushions, carpets and mats; library and wine cellar; abundant provisions; large and solid utensils. There is nothing to prevent having them: as in towns, there are 7 or 8 dishes at each meal. Water is brackish, but it is easy to carry ale, or to take a female camel which is watered often and which furnishes daily more milk than can be consumed by myself and servants. Thus it is that in spite of all dangers and fatigues, I am not yet disgusted with the desert, and my only desire is to traverse it anew. On the desert one is as if at sea. Like the sailor, the persistence of bad weather or calms may make him swear occasionally, but hardly has he touched land than he wants to go to sea again. One quickly tires of the monotony of a town, but one never tires of the monotony of the ocean, nor of the solitude of the desert." †

Meanwhile as we take our leave of this great subject (as it appears to us) the scent of the aromatic herbage seems to rise once more to the sense of smell as if to remind us that we ought to pause one moment to record the marvellous fragrance which pervades the majority of these desert shrubs and plants.

It is a special peculiarity of the vegetation generally throughout these almost rainless regions of maximum solar temperatures, that almost the whole of it is more or less powerfully scented. Some of these scents are of so exceedingly penetrating a nature, that they become at times actually oppressive: for instance, in Northern Arabia, there is a species of desert grass, so

* The load of a good camel will be about 400 lbs. of baggage, but it is better if possible to confine it to 350 lbs., if the journey is long or the country broken. Arabs, however, often put loads of 500 to 600 lbs. on powerful animals.

† *Le Désert et Le Soudan*, par M. le Comte D'Escayrac de Lauture, Paris, 1843, p. 625.

powerfully scented with the odour of camomile, that camels laden with it, which sometimes accompany the Arab caravans, literally cause the atmosphere to become impregnated with its aroma for immense distances to leeward. Meeting with one of these caravans we once sent home in a letter a little of the seed of this grass to a lady in Europe, as a sample of these most powerfully scented plants: it was, however, we were told, too strong to be pleasant, and so could not be kept in the house; and it had to be thrown out. But if there are these tremendously odoriferous plants, whose smell becomes obnoxious, because of its exceeding strength—there are also many other species whose delicious fragrance surpasses in delicacy and freshness all the highest triumphs of the perfumer's art. The scented acacia blooms we have already noticed: these, of course, are only produced during the season of growth; but among the herbage, the leaves of nearly all the dwarf plants are at all times strongly aromatic, but especially so at night, or after a rain storm. Mr. Gordon Cumming, the African hunter, among others, frequently speaks of this, and mentions that "the air of the South African wilds was loaded with balmy perfume emitted by the grateful herbs and plants." Proceeding to the northward of the Orange river, he notices that the small Karroo bushes were replaced by others of a variety different to those seen towards the South.

"Most of these" (he says) "yielded a strong aromatic perfume, more particularly when the ground was refreshed by rain; on which occasions the African wilderness diffuses a perfume so exquisite and balmy that no person who has not experienced its delights can form an idea of it." *

* *Five Years of a Hunter's Life in the Far Interior of South Africa*, by R. Gordon Cumming, 1850, Vol. i., p. 135.

Even the very skins of the animals he shot were deliciously scented by contact with it. So again the well-known German traveller and botanist, Dr. Schweinfurth, in his passage through the sterile tract between Suakim and Berber, in the Egyptian Soudan, mentions the delicious aroma emitted by the herbage at night. The air, he says, "was laden with scents which the stores of the perfumer could not rival, and such as no quarter of the world could surpass." * These perfumes he goes on to explain, were principally due to a little mountain weed (a "pulicaria") whose refreshing aromatic odour rendered the whole atmosphere sweet scented. Dr. Schweinfurth was at this time crossing the tract of desert between Suakim and Berber, and was encamped among the barren hills only a march or two from the coast, near a district which afterwards became famous as the scene of some of the fiercest battles fought between the British and the Arabs during the Soudan War of 1884.

Then again in "Le Désert" by Pierre Loti of L'Académie Française, which has but lately been published, the following description is given of the scented herbage of the Sinai peninsula in which he was encamped. There had been a night of severe storm and rain; followed by one of those lovely mornings of serene beauty which as frequently follow rain in these regions,—

"In the fresh tranquil morning" (says the French Academician) "at sunrise, when I open my tent, a puff of perfume reaches me with the outside air: so powerful, that it seemed as if someone had broken a pitcher full of aromatics before my door. And the whole of this solitary valley of granite

* *The Heart of Africa*, by Dr. Georg Schweinfurth, 2nd Edit., 1874, Vol. i., p. 20. Translated from the German by Ellen F. Frazer.

is thus embalmed, like a Temple of the East. These little scanty pale plants, which were perishing from drought, have recovered life under the downpour of the night, and now spread abroad their aromas like innumerable little bottles of perfume: one imagines the air filled with benzoin, with citronelle, with geranium, and myrrh. After a time I examine the ground from which all these perfumes rise: it is covered with white grains resembling hail stones after a storm. It appears to be manna which the wind and the rains of the night have brought with them. I collect these things; very hard white grains, tasting like wheat, the dried fruit of this dwarf prickly plant, which in certain places here have carpeted the mountains. In gathering the manna I lightly rubbed against these aromatics of the ground, and my hands for a long while remained exquisitely scented." *

In this picturesque description, we see the great wilderness of Sinai strewed with honey like drops of manna, and its atmosphere perfumed with the aromatic incense of desert herbage; and we are reminded of the words which of old were inscribed among the Mosaic records of the Scriptures, describing just such another scene, not far from the same spot.

"And when the dew that lay was gone up, behold upon the face of the Wilderness there lay a small round thing, as small as the hoar frost, upon the ground." †

"And the manna was as coriander seed, and the colour thereof as the colour of bdellium." §

This species of manna exudes plentifully, during the spring and summer months, from the branches of a dwarf shrub, which is very plentiful in the deserts of Sinai, known as the Manna Tamarisk (*Tamarix Gallica*

* *Le Désert*, par Pierre Loti, de l'Académie Française, 2nd Edit., Paris, 1895, pp. 33—35.

† *Exodus* xvi., 14.

§ *Numbers* xi., 7.

var. Mannifera), upon whose twigs and bark it appears in honey-like drops, which in the cool temperatures of the early mornings are found as described above, in a solid state: and in the valleys of these mountains it is collected by the Arabs, sometimes in large quantities, according to the amount of the rainfall, which promotes its secretion, though in common with many other vegetable exudations it is caused by the punctures made in the bark by an insect parasite—the Coccus Manniparous. * This manna is, however, different from the manna of commerce, obtained by making incisions in the stems of cultivated trees of the flowering or Manna ash (*Fraxinus Ornus*), † nevertheless it forms an article of local trade among the Bedouin tribes.

The desert hills all through the peninsula of Sinai are also covered with aromatic plants of which mention has been made, many of which consist of varieties of the Thymaceæ, § distinguished for their powerfully fragrant qualities which perfume the hands or garments of all who handle or touch them. Thus in the patriarchal times, in the historical narrative of the death of Isaac who, in accordance with the ancient custom of the period, called his successor to his bedside, to bless him before he died, we find the Scripture describing the raiment of Jacob as being thus scented with the herbage of the fields. We can have no doubt that it was through some recent contact with these aromatic plants, that it became thus perfumed. The passage runs as follows:—

"And his father Isaac said unto him, Come near now, and

* See the *Encycl. Brit.*, 9th Edit., Vol. xv., p. 493. Article "Manna."
† See *The British Pharmacopœia* of 1885, p. 265.
§ *Encycl. Brit.*, 9th Edit., Vol. xxii., p. 89. Article "Sinai."

kiss me, my son. And he came near and kissed him: and he smelled the smell of his raiment and blessed him and said,—See the smell of my son is as the smell of a field, which the Lord hath blessed; therefore God give thee of the dew of Heaven and the fatness of earth, and plenty of corn and wine." *

Thus Isaac blessed Jacob, taking as his parable this allusion to the sweet smelling incense of his fields. Scented herbage, we may add, is common to most dry regions, though in the colder countries, where it is found, its aroma is perhaps less generally powerful than where intense solar heat prevails. Nevertheless in exceedingly cold and sterile regions of the North, we have sometimes found the highly aromatic carraway (*Carum Carui*) whose seeds are used by confectioners for cakes, etc., growing in great abundance:—a good example of a like kind in a plant inhabiting the Arctic Zone may be cited in the delicately scented Angelica (*Archangelica Officinalis*), which is much used at table in a candied form for dessert purposes.

The subject of the desert flora is a large one, and thus far but little is to be learned about it in books. Contrary to the generally received opinion there are a good many edible plants, mostly of a bulbous character, and of so succulent a nature that not a few of them furnish both meat and drink to the native nomads. In the Kalahari Desert and the Great Namaqua thirst lands of Southern Africa they seem to be specially numerous. In South America, too, we have many times seen deliciously cool and fragrant fruits of a most refreshing character dug up out of the heated sand of very sterile tracts. These bulbs, which were

* *Genesis* xxvii., 26—28.

about the size of an orange, contained a soft pink and well flavoured flesh, not unlike that of a melon. We are careful to mention these facts, in order to show that even in the sandy waste all is not complete barrenness.

END OF VOLUME I.

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